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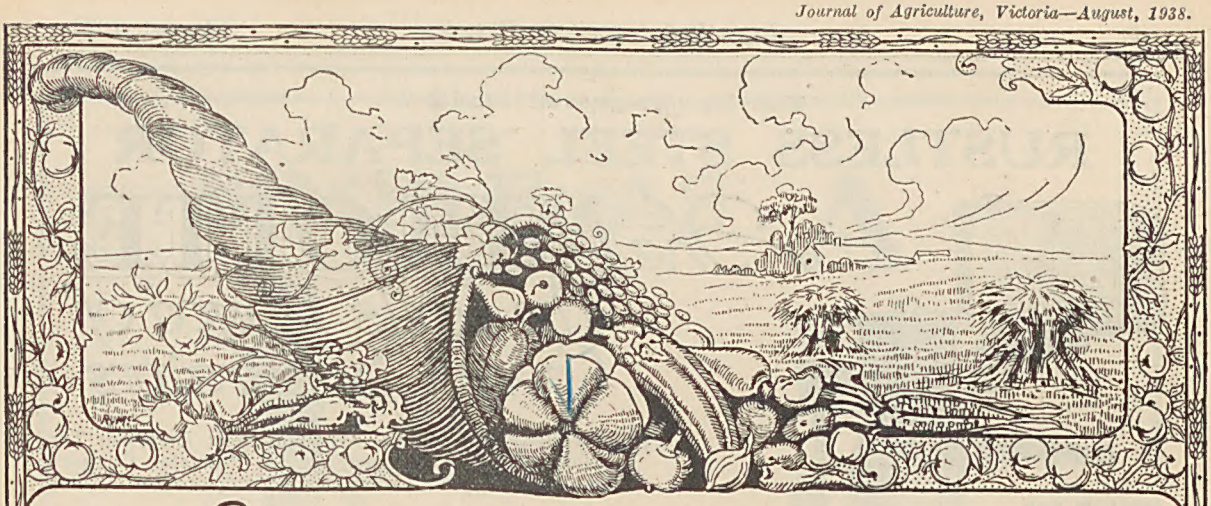

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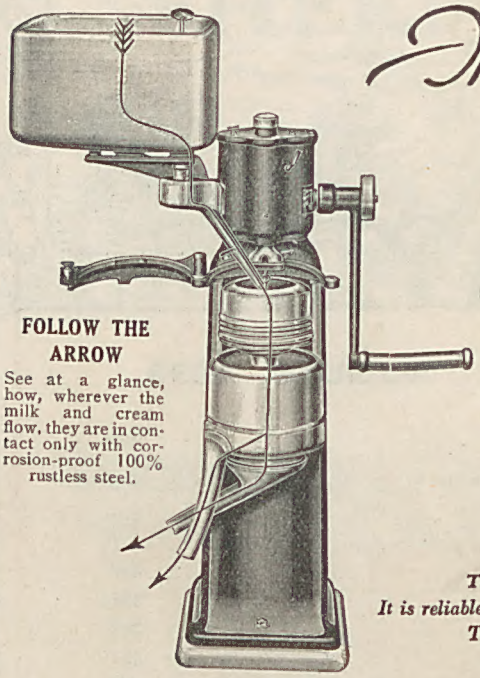

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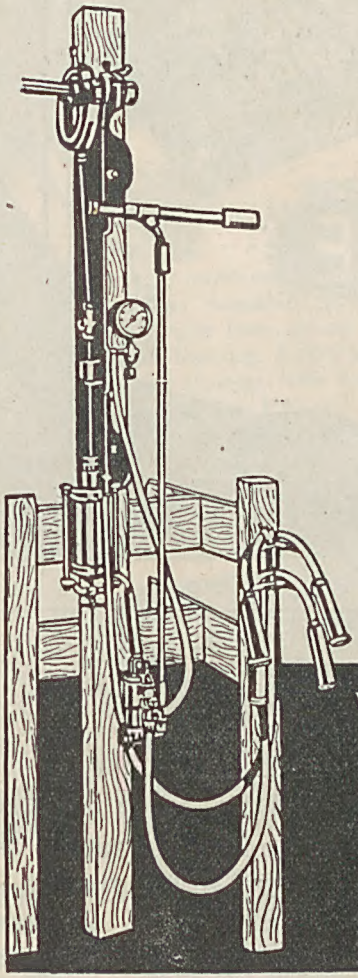
SIMPLE AS A B C



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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

August, 1938.

Tobacco in Victoria—1938

By W. J. B. McDonald, B.Agr.Sc., Senior Plant Investigation Officer.

Tobacco experimental plots in the Myrtleford district.

DURING the last five years the Victorian tobacco industry has been subjected to a steady process of elimination, in some cases an elimination of the careless or unsuitable grower—in the majority of cases an elimination of growers whose environmental conditions make it impossible for them to produce the sort of tobacco that present-day requirements demand. At the present time tobacco growing practically is confined to one large area—the North-east, and to two small areas at Gunbower and Nathalia. Pomonal cannot regain its past prestige without the development of an adequate irrigation scheme.

The next five years should be regarded as a period of consolidation by those growers remaining in the industry. The extent to which they improve their technique of production and quality of produce will determine largely the future of this State as a tobacco producing area. A decided failure on the part of existing growers to maintain a steady rate of improvement will inevitably re-act to their own disadvantage.

Considering Australia as a whole, a steady expansion in tobacco production is taking place. This expansion is not taking place in old-established areas, but in new ones which have

Tobacco curing barns in the Ovens valley.

been developed in North Queensland and Western Australia particularly, and which, to a certain extent, have captured the market at the expense of older producing districts. The north-eastern district in Victoria and portion of the Texas district in Queensland are the only old-producing areas in Australia which have been able to maintain their production figures and still market the bulk of their produce. The question inevitably arises as to whether Victoria can retain her status as a tobacco-producing State. The writer believes her stability in this regard is in the hands of her own growers, although it is doubtful if she will retain her pre-eminence as the biggest producing State. Queensland probably will eventually achieve this distinction, although as in all other parts of the Commonwealth, tobacco growers will have to overcome rather serious disabilities.

What are the essential differences between leaf produced in these new areas and that which was produced in some older areas like Tamworth and Tumut, which are turning to other avenues of production? In the first place the general soil type in the new areas is reported as being a rather infertile sand or sandy loam, while at Tumut and Tamworth the soil is generally acknowledged to be dominantly heavy fertile river flat. Here we have the key to the essential differences in leaf character. The new areas are producing very bright-coloured leaf, fine-veined and thin-webbed and not possessing very definite aromatic qualities. While in the other case we had comparatively heavy-bodied leaf naturally tending toward mahogany rather than bright-coloured tobacco, and possessing a marked aroma which could not easily be lost in a blend and which presumably did not appeal to the smoking public. Practically all the larger manufacturers in the eastern part of the Commonwealth are quite willing and eager to purchase new-belt leaf on a competitive basis and at prices which should be remunerative to growers.

Where does Victorian leaf stand in relation to these two extreme types of production? In my view it stands midway between the two and for a number of years at any rate holds a relatively safe place in the Australian market, provided Victorian growers exercise a reasonable amount of commonsense in the first place and, in the second, apply to the full the skill in producing a crop which a great number of them are known to possess.

At the present time Victoria is producing approximately 40 per cent. of bright tobaccoes, 40 per cent. of mahoganys and 20 per cent. of dark tobacco. It should be within our capacity to reduce the amount of darks to 10 per cent. and increase the brights to about 60 per cent. There is a limited market for dark and mahogany tobaccoes, and a fairly good market for bright full-bodied tobacco. Victoria should hold these markets easily provided the tobacco offered for sale can be confidently accepted by the buyer as being ripe or fully mature. During the past few years this question of an immature fraction in

each grade has gone a long way towards destroying confidence in Victorian production. It is the greatest drawback to our product and one that positively must be overcome. I believe it will pay growers to sacrifice a colour grade if, by so doing, proper maturity of the leaf is ensured. This may sound somewhat inconsistent with the supposition that Victoria can produce 60 per cent. of bright tobaccos, but it is believed that more attention to three broad principles enunciated below will enable this objective to be attained.

A glance at the accompanying table will show the sharp fluctuations in tobbacco acreage and production that have occurred since 1930 and will also show the very lean seasons growers have experienced for a number of years past. It will show also, however, that over the last three years the acreage planted to tobacco has tended to become stabilized at from 4,500 to 5,000 acres, a slight shrinkage still being evident. At the present time there is no justification for any marked increase in tobacco acreage in Victoria, although there is ample opportunity for increased production per acre.

Tobacco in Victoria is still a speculative crop and many growers are prone to accentuate the speculation by gambling on large acreages as well as against normal seasonal risks. It is more necessary to-day than ever before that growers restrict the acreage planted to an area that they are adequately equipped to handle, with respect to implements, barns, labour and finance. In a number of instances last year growers were unable to properly handle the amount of plantation established, with the result that gross returns per acre were unnecessarily low, while total expenses were unnecessarily high. In some cases it is considered that total gross returns were less than they would have been from a lesser acreage more efficiently handled. Almost inevitably a badly neglected crop means a poorly-cured product, which ruins the market for the low-grade fraction that is associated with even the best managed plantations. Each grower then owes it as a duty to the Victorian industry that he carefully assess the acreage he is equipped to handle and restricts his operations to that area.

Victorian Tobacco Production in Counties, 1931-2 to 1936-7.

	1931–32.				1932–33.				1933–34.			
	Acreage.	Yield.	Average Yield.	Average Price per lb.	Acreage.	Yield.	Average Yield.	Average Price per lb.	Acreage.	Yield.	Average Yield.	Average Price per lb.
	acres.	lb.	lb./ac.	s. d.	acres.	lb.	lb./ac.	s. d.	acres.	lb.	lb./ac.	s. d.
Delatite ..	4,571	2,579,024	564	2 0	5,057	1,647,072	300	2 0	3,507	596,176	170	1 10
Bogong ..	3,762	2,320,080	617	2 1½	3,920	1,142,736	275	2 0	3,022	391,776	130	1 10
Moira ..	1,391	729,120	524	1 11¾	1,608	566,384	352	1 10	707	144,032	204	1 9
Gunbower ..	369	233,408	633	2 0	374	192,528	559	1 11	115	20,048	175	1 11
Borung ..	997	370,608	372	2 3	1,500	318,528	212	1 7	945	216,608	229	1 9
Rodney ..	408	149,072	365	1 11	237	75,376	318	2 0	129	24,080	186	1 9
Total ..	12,191	6,658,512	546·6	2 0½	13,418	4,073,552	303·5	1 11	8,900	1,470,784	165	1 9½

	1934–35.				1935–36.				1936–37.			
	Acreage.	Yield.	Average Yield.	Average Price per lb.	Acreage.	Yield.	Average Yield.	Average Price per lb.	Acreage.	Yield.	Average Yield.	Average Price per lb.
	acres.	lb.	lb./ac.	s. d.	acres.	lb.	lb./ac.	s. d.	acres.	lb.	lb./ac.	s. d.
Delatite ..	1,794	613,536	342	1 10½	2,429	1,285,631	529	1 7	2,217	729,854	329	1 6½
Bogong ..	1,641	539,492	329	1 9½	2,025	1,104,771	537	1 7½	2,370	739,694	312	1 7
Moira ..	516	209,267	405·5	1 8¾	582	277,338	476·5	1 8	360	181,388	504	1 9½
Gunbower ..	54	31,725	588	1 10	55	40,479	736	1 6	85	54,100	636·5	1 11½
Borung ..	606	83,514	138	1 6½	599	139,476	233	1 6½	432	39,239	90·8	1 1½
Rodney ..	28	9,099	357	2 0½	8	5,800	725	1 8	7	5,000	714	1 9
Total ..	4,765	1,501,350	315	1 9½	5,840	2,879,075	493	1 7½	5,492	1,753,729	319	1 7

The 1930–31 figures (total) are as follows:—Acreage, 2,650 acres; yield, 1,269,520 lb.; average yield per acre, 479·4 lb.; average price per lb., 2s. 6d. (based on a return of £60 per acre).

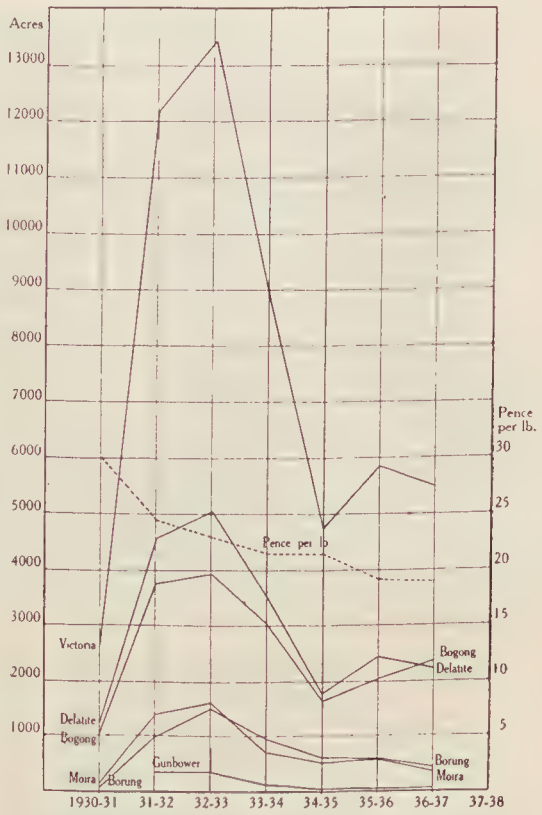
Estimated figures for 1937–38 are as follows:—Acreage, 4,500 acres; yield, 3,000,000 lb.

The above figures were obtained through the courtesy of the Victorian Government Statist.

Note re Counties.—The counties of Delatite and Bogong form the bulk of the North-East—the Ovens River forming the boundary between the two; the county of Moira includes Shepparton East, Nathalia, and Cobram; the county of Gunbower includes the Gunbower Island; the county of Borung includes Pomonal, Dadswells Bridge, and Haven near Horsham.

The selection of the most suitable tobacco growing soils within the tobacco growing districts is another aspect that could be more frankly acknowledged by growers. There are still a few properties in the north-east which are not well suited to tobacco production, but the majority of growers possess or can gain access to soil types which are recognized as producing better quality tobacco. It is not so very long since the whole of the tobacco growing soils of the north-east were regarded as rich heavy river flats. This was an extraordinarily erroneous view. There are large areas on both the Ovens and Buffalo river flats which could be more accurately described as fine sands or fine sandy loams and it is on these lighter soil types that the north-east is considered to produce its best quality tobacco. In some places this soil type extends as an unbroken sheet over large areas, while in others it occurs as relatively small pockets. Growers are strongly advised to exploit these lighter sandy areas in preference to the stronger soils tending to the clay loam type. It is considered that a much greater selection of suitable soil type could be practised without seriously reducing the acreage of tobacco plantation.

The third cardinal point that the grower must recognize is the necessity for picking only ripe tobacco. Victorian tobacco does not mature as quickly or as evenly as that in more northern States, nor does it mature as readily in bulk. Consequently, extreme care is necessary in picking our plantations. In respect to this question of



Showing fluctuation of tobacco acreage for various counties.

Irrigating experimental plots in the Gunbower district.

Dusting and weeding tobacco seed beds.

maturity we must recognize the fact that the conception of "green" has altered vastly in the last few years. It is a dangerous policy to rely on leaf "moving in the bulk." To ensure a good sale it must come out of the barn in a fully coloured mature condition. Compared with the produce of some other States, Victorain production has been justly criticized on occasions in respect to the amount of immature leaf offered for sale.

There are still some growers who find it difficult to forget that at one time green tinged leaf was not penalized in price. Its sale at the present time is almost impossible, not because the buyer desires to penalize the grower but because they have learned to their cost that leaves carrying a definite green tinge do not mature satisfactorily in bulk and that green leaf makes a bitter smoke. The principle which compels manufacturers to use a certain percentage of Australian tobacco in all of their blends assures a definite market for a fair quantity of Australian leaf but it also has forced the manufacturer to insist on a high-grade product from the grower, not only from a colour point of view but from the point of view of smoking quality also. Full maturity is a pre-requisite in any grade of leaf for smoking quality.

A further natural result of "compulsory percentages" is a stricter insistence on uniformity of grade. If local leaf is to be incorporated in high-grade products it is essential from the manufacturers' point of view that no low-grade leaf should creep in—particularly no "immature leaf" as it is difficult to "lose" the flavour of even a very small proportion of green leaf.

Victorian grading probably compares favourably with that of any other State, but we are grading a product that does possess definite character and that is naturally handicapped by irregular ripening and a greater tendency towards immaturity, consequently we must become 100 per cent. efficient in this respect if we are to restore to our product a confidence that has become somewhat shaken over the past unfavourable seasons.

London Markets

Weekly Prices

The following information as to prices offering in London for the principal Victorian primary products has been taken from cablegrams received each week by the Department of Agriculture from the Victorian Agent-General in London.

Product.		Price for Week Ending—				
		1st July.	8th July.	15th July.	22nd July.	29th July.
		d.	*d.*	*d.*	*d.*	*d.*
Lamb, 1st quality, Victorian	29–36 lb.	7	7⅛	7⅛	7¼	7¼
Lamb, 1st quality, Victorian	37–42 lb.	6⅞	7	7	7	7⅛
Lamb, 1st quality, other States	29–36 lb.	6⅞	7	7	7	7
Lamb, 1st quality, other States	37–42 lb.	6¾	7	7	7	7
Lamb, 2nd quality, Victorian	28 lb. and under	7⅜	7¼	7¼	7¼	7⅛
Lamb, 2nd quality, Victorian	29–36 lb.	6¾	6¾	6¾	6⅞	6⅞
Lamb, 2nd quality, other States	28 lb. and under	7¼	7¼	7¼	7	7
Lamb, 2nd quality, other States	29–36 lb.	6⅝	6⅝	6⅝	6½	6½
Lamb, 3rd quality, all States	28 lb. and under	6¾	6¾	6¾	6⅝	6½
Lamb, 3rd quality, all States	29 lb. and over	6½	6½	6⅜	6¼	6¼
Mutton wethers and/or maiden ewes	Under 40 lb.	4	4	4	4	3⅞
Mutton wethers and/or maiden ewes	41–48 lb.	3¾	3¾	3¾	3⅞	3½
Mutton wethers and/or maiden ewes	49–56 lb.	..	..	..	..	..
Mutton ewes	Under 40 lb.	3¾	3¾	3⅞	3¾	3¾
Mutton ewes	41–48 lb.	3½	3½	3½	3⅜	3⅜
Beef, frozen ox hinds	145–210 lb.	..	..	..	..	..
Beef, frozen ox crops, weights corresponding		..	..	..	..	..
Beef, chilled ox hinds	145–210 lb.	4⅝	5⅛	5	5¼	4¾
Beef, chilled ox crops, weights corresponding		2⅝	3¼	3¼	3¼	2⅝
Pork, Australian 1st quality	60–80 lb.	6¾	6¾	6⅞	6¾	6¾
Pork, Australian 1st quality	81–100 lb.	6⅝	6⅝	6⅝	6⅝	6⅝
Pork, New Zealand, 1st quality	60–80 lb.	6¾	6¾	6⅞	6¾	6⅝
Pork, New Zealand, 1st quality	81–100 lb.	6¾	6⅝	6⅝	6⅝	6⅝
		s.	*s.*	*s.*	*s.*	*s.*
Bacon, Canadian	per cwt.	96	100	104	104	98
Bacon, Empire (cured in England)	per cwt.	93	97	101	101	94
Bacon, Danish	per cwt.	99	102	106	108	103
Butter, unsalted, choicest grade	per cwt.	122–123	120–122	120–122	120–121	120–121
Butter, unsalted, 1st grade	per cwt.	121	119	..	..	119
Butter, unsalted, 2nd grade	per cwt.	..	..	..	..	..
Butter, unsalted, pastry grade	per cwt.	..	..	..	..	..
Butter, salted, choicest grade	per cwt.	121–122	119–120	119–121	120–121	119–120
Butter, salted, 1st grade	per cwt.	120	118–119	118–120	119–120	118–119
Butter, salted, 2nd grade	per cwt.	118–119	117	116–118	118–119	117–118
Butter, salted, pastry grade	per cwt.	115–116	..	..	..	..
Butter, Danish	per cwt.	122	120	122	124	123/6
Market (butter)		Quiet, prices easier.	Market closed quieter.	Active demand early Closed firmer.	Quiet but steady.	Limited demand.

Codling Moth and Black Spot Control

Apple and Pear Demonstration Plots, 1937-38

IN 1936 the Department of Agriculture established a series of demonstration plots in the principal apple and pear growing districts of Victoria, with the object of demonstrating, on a commercial scale, its recommendations for the control of two major pests of apples and pears, namely, Black Spot of apples (*Venturia inaequalis*), Black Spot of pears (*Venturia pirina*), and Codling Moth (*Cydia pomonella*) of both these fruits. The initiation of the work was made possible by funds provided by the Commonwealth Government, and the readiness with which orchardists, in the various districts, made available their properties for this work.

At the beginning of the 1937–8 season, insufficient funds were available to ensure continuation of the work, but fortunately the orchardists concerned willingly made available their orchards and equipment for a further season, and provided the bulk of the spray materials. This gesture was greatly appreciated by the Department as otherwise the work would have been seriously curtailed. Financial assistance has been made available for the plots to be continued during the 1938–9 season.

The total number of plots for the 1937–8 season was twenty, a reduction of four from the previous season's total. The four plots discontinued were those at Drouin (Mr. D. Grant), Bacchus Marsh (the late Mr. A. Durham), Amphitheatre (Mr. W. Collins) and Harcourt (the late Mr. T. Code). In addition to the above, it was found necessary to change the location of the plot in the Geelong district from Mr. Ling's orchard, Wallington, to that of Mr. M. Ellwood, Batesford, while the Harcourt pear plot on Mr. G. Douglas' orchard was retained only for fertilizer trial purposes. It is hoped to resume demonstration work in the Amphitheatre district during the 1938–9 season, and, if possible, in those other districts previously served by a plot.

The twenty plots comprised twelve apple plots, seven of which were located south, and five north of the Divide, and eight pear plots, four in the north, and four in the south. The total area of the plots was approximately 55 acres, and comprised ten varieties of apples, and five varieties of pears. Jonathan and Williams were the principal varieties of apple and pear respectively.

In addition to the pest control work there was also initiated on eighteen of the plots a series of fertilizer trials to demonstrate and compare the effectiveness of applications of sulphate of ammonia and complete fertilizer. During the autumn of 1937 and 1938 green manure crops were sown on all plots, but, unfortunately, weather conditions in both seasons did not favour their establishment on many of the areas. In both seasons fruit from certain of the apple plots has been placed in cool storage, with a view to observing the possible effects of fertilizer and spray schedule treatment. Progress reports on these three phases of the work are given at the conclusion of this Report.

Codling Moth Control.

In setting out to demonstrate the control methods for codling moth it was considered fundamental to "time" the spray applications according to moth activity throughout the season. In order to appreciate the significance of this method it is equally fundamental to have a clear understanding of the more important features of codling moth life-history.

During spring the over-wintering larvae pass into the pupal condition in which they remain

for approximately three weeks, and then, given favorable temperature conditions, emerge from the cocoons as adult moths of the spring brood. This emergence usually commences about mid-October and continues until late November or early December. At some time during this period the number of moths emerging reaches a maximum and then declines until the brood has completely emerged.

After emergence, a period of two to three days elapses before moths lay eggs, and then only when temperature conditions are favorable. Warm evenings, when temperatures are in the vicinity of 60° F., are most favorable and the majority of the eggs are laid then. The eggs hatch in from five to fourteen days according to temperature conditions. Incidentally, the variation in this factor is of vital importance in timing sprays, and will be referred to again. The larvæ developing from these eggs (termed first brood larvæ) have a feeding period of three to four weeks after which they leave the fruit and spin up in cocoons, usually under rough bark on the tree itself, pass into the pupal condition, and after a further period of two or three weeks, emerge as adult first brood moths. The length of the life cycle from egg to adult moth varies from 50 to 60 days, a fact which is of significance in estimating the likely appearance of successive broods of moths. The life of an adult moth is approximately a fortnight. During the summer months the life cycle may be passed through two or three times according to temperature conditions, frequently with considerable overlapping of the broods.

The first important consideration is that in most fruit-growing districts of Victoria, there are normally two or three broods of moths during the growing period of the fruit, and since each brood may be spread over a period of four to six weeks, it is obvious that some form of systematic spraying is required throughout the whole season. The next important point to consider is the amount of activity displayed by moths after they have emerged. It is this activity that will determine the number and time of application of sprays. As was mentioned earlier, temperature exerts a profound effect on egg-laying, as it does, in fact, on all stages of the life-history. The number of days favorable for egg-laying (i.e., codling moth activity) may vary tremendously from one brood to another, and from one season to another.

Fortunately codling moth activity can be recorded remarkably accurately by the use of sensitive lures, which are simply jars containing attractant liquid in which moths are trapped. (These are more fully described under a separate heading.) Moths are trapped only when temperature conditions are favorable for flight and egg-laying, and a well kept lure is remarkably sensitive in this regard.

The graphs reproduced in this Report serve as illustrations of the method of using lures. At least once a week (twice a week in most cases and at critical periods), the number of moths trapped was recorded and shown in the form of a graph. The period of maximum activity (peaks) indicate that conditions were then very favorable for egg-laying, while the periods of relative inactivity either indicate that temperatures were unfavorable or that there were very few moths emerging during those periods.

The primary object of timing sprays, therefore, is to ensure that they are applied during periods of maximum moth activity so that they will be most effective. The actual technique of timing sprays demands a knowledge of moth activity, life-history, and local conditions, and cannot be resolved into a simple formula since seasonal conditions exert such a profound effect. Each brood usually is sufficiently active and of sufficient duration to require two, and sometimes three sprays. Each spray applied has, of course, a certain effective period which enables minor fluctuations of moth activity to be provided for.

Experience gained during the 1936–7 season indicated that all cover sprays for the control of codling moth should be timed with the aid of lures, and that the only spray not so timed should be the calyx spray. This is more fully referred to in the recommendations for 1938–9.

The actual relation of a spray to a peak of moth activity depends on the probable incubation period at the time. The average incubation period of eggs in the spring may be approximately ten days, while in the summer it may be as low as five days. But at peak periods of activity, when temperatures are very favorable, the incubation period may be very much less than the average. It can be seen that generally there is more time available to complete a given spray in the spring than in the summer. To be on the safe side, however, it is highly desirable that growers should be able to thoroughly spray their entire orchard in four or five days following a peak of moth activity.

Reference to the graphs shown in this Report indicate how sprays can be made to deal with codling moth at critical periods. It can also be appreciated that spraying at regular three-weekly intervals, for instance, could result in completely

missing vital periods. If the interval was longer the position would be worse, while, if shorter, spray material would frequently be wasted. Recommendations for the control of codling moth are given at the conclusion of this Report.

Codling Moth Activity 1937-38.

Before considering the results obtained for the control of codling moth on demonstration plots, it is desirable to consider some of the more important features of codling moth activity during the season. An interesting comparison of the conditions in the last two seasons is afforded by Graph I., in which the total number of moths caught each week, on all plots, is shown. Since moths are trapped in lures when temperatures are favorable for egg-laying, it is apparent that conditions were much more favorable for codling moth activity in 1937–8 than in the previous season. This is further emphasized by the number of moths trapped per lure each season. In 1936–7 an average of nineteen moths was trapped by each lure, while in 1937–8, the number was 47. It is apparent that more intensive spraying would be required in the latter season, and it is not surprising that many growers experienced greater difficulty than usual in controlling codling moth.

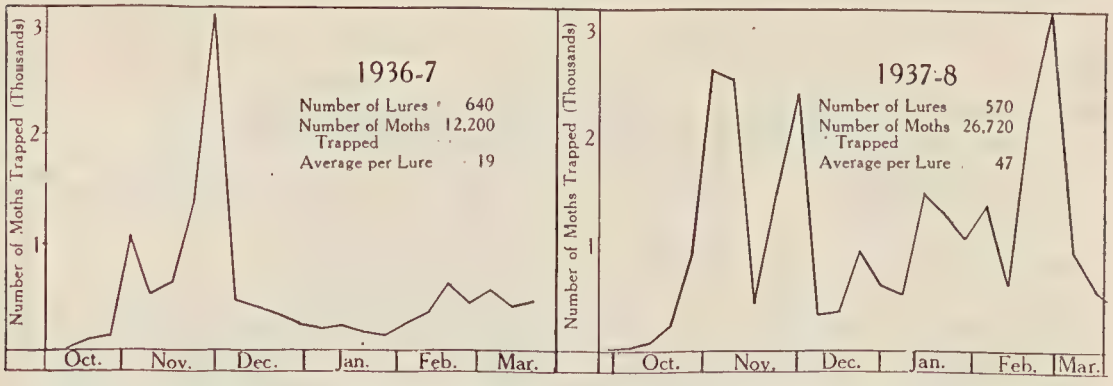
The over-wintering or spring brood of moths commenced to emerge about mid-October, and with the occurrence of favorable temperatures, late in October and during the first two weeks of November, large numbers of moths were trapped. A cool spell of almost two weeks was followed by rising temperatures and heavy moth catches in late November and early December. Moth activity in December was relatively low, but in early January, the first-brood moths commenced to emerge, and thereafter on many plots codling moth activity was more or less continuous until harvest time.

In every district, except Stanley, there was an indication that at least two broods had been active during the season. At Stanley only one brood was active, and consequently it was possible to cease spraying in December. In certain other districts, notably Pomonal, Strathfieldsaye, Harcourt, and Bamawm, three broods were active. During the previous season there were two broods at the most, the second brood, being relatively inactive as shown by the lure records for that season.

Codling Moth Lures.

The lures as used on demonstration plots were straight sided glass jars containing ½ to ¾ pint of an attractant fluid. The jars were generally suspended in the upper part of the tree, or at least, as high above the ground as they could be conveniently placed. It should be emphasized that their principal value is for timing sprays, and therefore, it was necessary to use a limited number only. Previous experience had indicated that twenty lures distributed evenly over the plot at the rate of about eight per acre was a satisfactory number.

The lures were established in all districts by mid-October. In the Goulburn Valley, however, they should be established during the first week of October to catch early moths. Each week the number of moths trapped was recorded in the form of a graph. Wherever practicable, readings were made twice a week, and as a result, of the past season's work, it is apparent that readings of this frequency at least, are desirable to ensure accurate spray forecasting. The lure material used most extensively in the 1936–7



Graph I.—Showing total number of moths trapped each week in all lures in demonstration plots during the 1936-37 and 1937-38 seasons. The graph indicates the difference in codling moth activity for the two seasons.

season was a 10 per cent. solution of malt vinegar which previously had been found effective. It was apparent, however, that several other materials attracted larger numbers of moths and were more sensitive. These materials include sweet-wine lees, cider, apple juice, golden syrup, and molasses. Table I. gives an indication of the relative efficiency of these materials during the 1937–8 season.

The wine referred to was the lees from sweet-wine rackings. Apple juice was made simply by allowing the juice from decomposing apples to collect in a container, a crude method which could be improved easily. The cider was a product which had deteriorated slightly. Any of these lures are suitable for the purpose of recording codling moth activity.

The lures were recharged weekly with 10 per cent. solutions of any of the liquid materials mentioned, or a 1 : 15 solution of golden syrup or molasses. Lures must be retained in a fresh condition, and excessive fermentation can be prevented by the addition of a trace of bluestone. The scum sometimes formed, particularly with vinegar, may completely prevent moths from being trapped.

TABLE I.—NUMBER OF MOTHS TRAPPED PER POT USING VARIOUS LURES.

Number of Plots.	Lure Material.				
	Vinegar.	Molasses.	Golden Syrup.	Cider.	Wine.
3 ..	28 (60)	44·5 (30)	..	..	..
1 ..	30 (20)	..	55·5 (10)	..	..
7 ..	31 (130)	..	..	50·5 (80)	..
1 ..	..	..	..	102 (20)	216 (10)
1 ..	53·5 (20)	..	..	..	215 (10)

Number of lures shown in brackets.

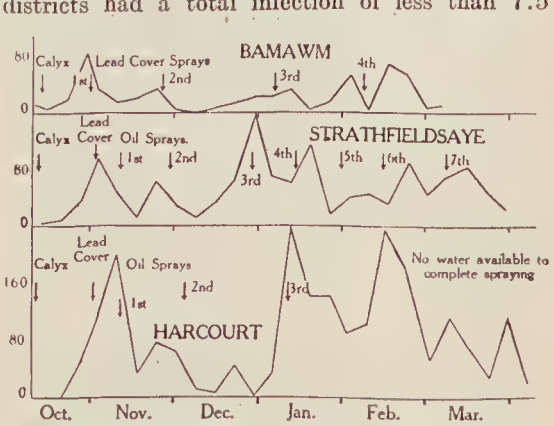
APPLE PLOTS.

Two main spray schedules were used on the apple plots, one comprising calyx and cover sprays of arsenate of lead only, and the other employing summer white oil to replace the later cover sprays of arsenate of lead. In Table II. these have been referred to as schedules "A" and "B" respectively. The object of using the latter schedule is to overcome the arsenical residue problem, and to do this, it is not desirable to apply arsenate of lead within two months of harvesting the fruit. The time at which oil was introduced varied according to conditions in each district, but the tendency on demonstration plots has been to introduce it for control of the first brood in November, particularly in warmer inland districts. It is practically impossible, however, to do this where black spot control demands the use of lime sulphur spray applications which may react with white oil to cause extensive spray injury.

On the majority of plots, the total number of sprays varied from six to eight, and "B" schedule plots included two to seven white oil sprays. At Stanley, where only one brood of moths emerged, only three sprays (arsenate of lead) were required, while at Quantong nine to eleven sprays, according to variety, were used chiefly because of the excessive codling moth activity in January and February.

Owing to the shortage of water at Harcourt and Strathfieldsaye, it was necessary to abandon spraying after mid-January except on a small area of Granny Smith apples at Strathfieldsaye. At the time spraying ceased, infection was of the order of 5 per cent. on these plots, and the results of a complete season would have been extremely interesting, especially in view of the fact that white oil had been introduced unusually early in the season (11th November).

Referring to the results, set out in Table II., it is to be noted that the records include total infection (entries and stings) of both picked and windfall fruit. Five of the plots in the southern districts had a total infection of less than 7.5



Graph II.—Showing number of moths trapped each week in lure pots on three typical northern plots.

per cent., while at two plots, Wantirna and Croydon, the infections of the various varieties in the two schedules ranged from 15.7 to 62.5 per cent. The highest infection on those northern district plots, on which spraying was completed, was 7.7 per cent. At Harcourt, where spraying could not be completed, 35 to

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40 per cent. of the fruit was infected at harvest time as the result of excessive codling moth activity in January and February. This activity is clearly shown in the Harcourt lure graph (Graph II.).

Fortunately a small area of the variety Dunn's was made available by Mr. W. Eagle, on whose orchard the water supply was assured and who carried out the Department's recommendations for the time of application of the sprays. Using a schedule which included six applications of summer white oil total infection 11·4 per cent. was considered very satisfactory in view of the lightness of the crop on this block.

In view of the greater amount of codling moth activity in 1937–8 than in 1936–7, it is of interest to trace the effect of this on the results obtained on those plots which had received similar treatment in both seasons, namely, Red Hill, Tyabb, Strathfieldsaye, Stanley, Pakenham, Quantong, Pomonal, Wantirna, Croydon, and Panton Hill. Regarding each variety and schedule as a unit, these plots comprised 24 units which had received similar treatment in both seasons. Eleven of the units, namely, Red Hill and Tyabb (Jonathan "A" and "B"), Strathfieldsaye (Granny Smith), Stanley (London Pippin, Granny Smith), Pakenham (Jonathan "A" and "B," Yates), and Quantong (Rome Beauty), showed a smaller number of infected fruit per tree in 1937–8 than in 1936–7. The differences at Red Hill, Tyabb, Stanley, and Pakenham were slight only, while at Strathfieldsaye the number of infected fruit was reduced from 74 to 10, and at Quantong the reduction was from 141 to 69 on the Rome Beauty trees. Both of the latter plots were heavily infected in the previous season, thus indicating an improvement in control in these cases.

TABLE II.—CODLING MOTH AND BLACK SPOT INFECTION—APPLE PLOTS.

District.	Orchard.	Variety.	Spray Schedule.	Number or Trees.	Average Yield of Fruits per Tree.	Infection Due to—	
						Codling Moth.	Black Spot.
						%	%
Red Hill ..	Mr. G. W. Brown ..	Jonathan ..	A	154	790	3·9	1·2
		Jonathan ..	B	128	670	4·3	
		Rome Beauty	A	38	900	5·5	2·9
		Rome Beauty	B	64	900	5·8	
Tyabb ..	Messrs. S. Borley and Sons	Jonathan ..	A	130	360	1·6	1·4
		Jonathan ..	B	130	440	4·0	
Pakenham ..	Messrs. G. Woolf and Sons	Jonathan ..	A	168	220	1·9	1·9
		Jonathan ..	B	152	135	2·5	
		Yates ..	A	86	410	2·9	4·5
		Delicious ..	A	101	215	1·7	7·4
Wantirna ..	Mr. J. L. Murdock ..	Jonathan ..	A	220	276	37·0	1·3
		Jonathan ..	B	164	400	27·3	
Croydon ..	Mr. D. Lipscombe ..	Jonathan ..	A	92	145	62·5	2·8
		Jonathan ..	B	60	380	38·4	
		Democrat ..	A	88	180	23·8	2·2
		Democrat ..	B	60	390	15·7	
Panton Hill ..	Mr. S. Cracknell	Jonathan ..	A	81	650	7·4	5·3
		Jonathan ..	B	33	730	3·8	1·0
		Rome Beauty	A	38	670	3·0	..
Batesford ..	Mr. M. Ellwood	Dunn's ..	A	72	844	3·0	8·2
		Dunn's ..	B	66	658	2·7	
		Rome Beauty	A	64	193	7·2	0·1
Quantong ..	Mr. R. Gersch	Cleopatra ..	B	33	1,900	4·3	6·6
		Rome Beauty	B	33	1,200	5·8	6·6
		Rokewood ..	B	22	2,000	6·7	0·5
Pomonal ..	Messrs. Cox Bros. ..	Cleopatra ..	A	200	1,480	7·7	5·2
Strathfieldsaye..	Messrs. Somerville Bros. ..	Granny Smith	B	68	315	3·2	Nil
Harcourt ..	Mr. W. Eagle	Dunn's ..	B	35	310	11·4	..
Stanley ..	Mr. N. Pope	Granny Smith	A	56	1,040	0·7	2·1
		London Pippin	A	102	1,170	1·0	1·9

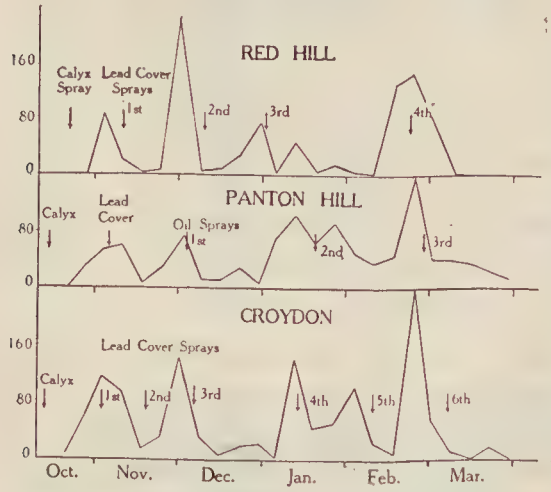
NOTES.—1. Yield and infection include windfalls. 2. Codling moth infection includes stings, calyx and side entries. 3. Spraying not completed at Harcourt (Ford Bros.) and Strathfieldsaye, because of water shortage.

The remaining thirteen units showed a larger number of infected fruit per tree, namely, Red Hill (Rome Beauty "A" and "B"), Pakenham (Delicious), Wantirna (Jonathan "A" and "B"), Croydon (Democrat and Jonathan "A" and "B"), Panton Hill (Jonathan), Quantong (Cleopatra and Rokewood), and Pomonal (Cleopatra). The differences at Red Hill, Pakenham, Panton Hill and Pomonal were only slight, but at Wantirna, Croydon, and Quantong, the number of infected fruit, per tree, was more than double that of the previous season. At Wantirna and Croydon very light yields, varying from one to two bushels, were obtained, and this was the most important factor in the high percentage of fruit infected on these plots. Inefficient spraying, and excessive codling moth activity were also factors in the relatively poor results obtained on these plots.

Portion of the Jonathan apple demonstration plot on the property of Mr. G. W. Brown, Merricks North.

At Quantong it is significant that the rate of spray application, 1 to 1¼ gallons per tree, was the lowest of all plots in spite of the fact that the crop was the heaviest. Both Quantong and Pomonal plots were heavily infected in 1936–7, and while the percentage of infected fruit in 1937–8 was much lower because of the higher yields, the number of infected fruit per tree was greater.

The results indicate that, in spite of the more favorable conditions for codling moth activity in 1937–8, control of codling moth was maintained satisfactorily on all apple plots, except, in particular, Wantirna and Croydon where very low yields were obtained. On all plots, except Pakenham, one and sometimes two calyx sprays of arsenate of lead were applied. As a result calyx infection of apples was practically negligible. It is desirable to regard the calyx application as a routine spray in all seasons since it appears that in exceptional cases only, such as districts where codling moth is relatively inactive, can this spray be dispensed with. Growers at Pakenham usually omit this spray and in the last season it was omitted from the spray schedule on the demonstration plot. It is possible that in some seasons and for some varieties this spray may be required even at Pakenham.



Graph III.—Showing number of moths trapped each week in lure pots on three typical southern plots.

White Oil.

White oil emulsion sprays were used on eleven of the twelve apple plots, and in nine of these cases the plots were divided into two similar areas, one of which was sprayed with arsenate of lead throughout the season, while the other received white oil emulsion sprays instead of the later cover sprays of arsenate of lead. During the two seasons that this procedure has been adopted, the average infection for all plots receiving both schedules has been practically the same, showing that white oil is at least as effective as arsenate of lead as a control for codling moth. It has the additional great advantage of overcoming the arsenical residue problem.

During the 1937–8 season the comparisons, referred to above, could be made on southern plots only, and it is, therefore, not possible to state which, if either, of the two insecticides is

the superior in the warmer inland districts. The excellent results obtained at Harcourt (W. Eagle) and Strathfieldsaye during the past season, indicate that summer white oil carefully timed and thoroughly applied will provide effective control of codling moth in those districts. In both of these cases white oil was introduced into the spray schedule early in November for the control of the first brood and was used for the remainder of the season.

PEAR PLOTS.

Arsenate of lead sprays were used almost exclusively for the control of codling moth in pears. The all-important calyx spray was applied approximately three weeks after petal-fall, advantage being taken of the fact that the calyx of pears closes slowly and can be more effectively filled with spray at this delayed stage, provided the young fruits have not turned over. In one instance, Tyabb, one cover spray of white oil was used in accordance with the orchardist's normal practice of applying oil during the latter part of the season to avoid excess arsenical residue.

The results set out in Table III., indicate a much lower range of infection than that experienced in apples, and, in fact, one plot only, Bamawm, showed more than 5 per cent. infection. Slightly less effective control was obtained in the northern district plots due to the more favorable temperature conditions. The results obtained at Bamawm on a plot including five varieties of pears were the least satisfactory. Infection in the earlier picked varieties, Williams, Beurré Bosc, and Packham's Triumph, did not exceed 8·6 per cent., but Josephine pears picked in mid-March were very highly infected (36·8 per cent.), mainly with "late stings," while, Winter Nelis pears, picked later in March were only slightly more infected than the earlier picked varieties. The principal cause of the high infection of Josephine pears was the failure to apply a sixth spray of arsenate of lead during the latter part of February when codling moth was particularly active. This was indirectly due to a previous belief that the fruit would be harvested before danger of infection, and as the fruit was intended for export it was not desired to increase the arsenical residue. A further

TABLE III.—CODLING MOTH AND BLACK SPOT INFECTION—PEAR PLOTS.

District.	Orchard.	Variety.	Number of Trees.	Average Yield of Fruits per Tree.	Infection Due to—	
					Codling Moth.	Black Spot.
					%	%
Tyabb ..	Mr. F. C. Renouf	Packham's ..	120	690	0·1	0·4
		Beurré Bosc ..	26	310	0·15	..
Burwood East..	Mr. V. L. Fankhauser ..	Packham's (*a*) ..	48	355	2·1	1·8
		Packham's (*b*) .. (See Note 3)	192	220	3·2	28·4
		Winter Nelis ..	48	670	0·9	20·0
Doncaster ..	Mr. E. Thiele	Beurré Bosc ..	72	340	0·2	Not
		Winter Nelis ..	72	160	0·3	recorded
		Josephine ..	144	118	1·9	here
Croydon ..	Mr. D. Lipscombe ..	Beurré Bosc ..	160	240	0·9	7·0
Lancaster ..	Mr. W. Young	W.B.C. ..	208	800	4·5	Nil
Ardmona ..	Mr. V. R. McNab ..	W.B.C. ..	106	1,400	2·5	Nil
Shepparton ..	Mr. W. Mulconry	W.B.C. ..	322	530	3·7	Nil
Bamawm ..	Mr. J. Sinclair	W.B.C. ..	66	670	7·0	..
		Beurré Bosc ..	57	575	5·2	..
		Winter Nelis ..	44	665	11·1	Nil
		Josephine ..	37	630	36·8	..
		Packham's ..	40	550	8·6	..

NOTES.—1. Yield and infection include windfalls. 2. Codling moth infection includes stings, calyx, and side entries. 3. The third Bordeaux mixture spray at Burwood East was interrupted by rain on 15th October. The small portion (*a*) was sprayed before the rain.

important factor was the failure of the home-made chemical bands used on this property. At least 50 per cent. of the larvæ which entered the bands transformed to adult moths during February. In addition, the concentration of the February brood on the late varieties after the earlier ones had been harvested was a factor of considerable importance.

The control of codling moth obtained in certain late varieties of pears, such as Josephine and Packham, in the Goulburn Valley is not always satisfactory. While these varieties are evidently more susceptible to late infection than certain other varieties, such as Winter Nelis, most varieties of pears approaching maturity appear to present similar difficulties in control. The principal reason for late infection is probably that vital sprays are neglected for other work or missed because of irrigation.

It is intended to establish a plot in the Shepparton district next season to demonstrate the control of codling moth in a late variety such as Packham or Josephine. In view of the importance of these varieties in the export trade, it may be necessary to consider the use of summer white oil to overcome the residue problem. Some such action will be necessary at Bamawm. Very careful timing of sprays is necessary because of the short incubation period of eggs under favorable temperature conditions in the Goulburn Valley, and the necessity to fit in with irrigation practice.

Black Spot Control.

For full details of the spray schedules used in the control of black spot, reference should be made to the recommendations for the 1938–39 season (see later). Briefly, the pear schedule consisted of three applications of Bordeaux mixture at the "green tip" and "finger-tip" stages, and approximately three weeks after petal-fall. The principal apple schedule used included a single Bordeaux mixture spray at the "green tip" stage, followed by lime-sulphur applications just prior to blossoming, at petal-fall and again a fortnight later. For certain varieties not liable to russet, two pre-blossom sprays of Bordeaux mixture, one at the "green tip" stage and the other at the "pink" stage, were used. A full description of the various stages at which sprays are applied and the treatment of varieties liable to russet injury is given in the recommendations for next season.

Weather conditions in the spring of 1937 were rather more favorable for black spot development than in the previous spring, but where the sprays had been applied correctly according to the schedules, little difficulty was experienced in controlling infection. During mid-October, however, very heavy rains were accompanied by mild temperatures which were favorable for the development of black spot. At this stage the application of the third Bordeaux mixture spray to pears and the petal-fall lime-sulphur to apples was frequently interrupted, and instances of this occurred at Panton Hill and Burwood East. In the former case two rows of Jonathan apples had received lime-sulphur, 1½ in 80, at the petal-fall stage when rain intervened. The spray failed to dry, with the result that 20 per cent. of the fruit on these two rows was severely russeted, but a trace only of black spot infection resulted. The remainder of the plot sprayed after the rain was free from russet, but at harvest time 5·3 per cent. of the fruit was rejected for spot. At Burwood East two rows of Packham pears were sprayed before the rain with a half strength Bordeaux mixture spray. These developed only 1·7 per cent. spot, whereas the remainder of the block, sprayed five days later, showed 28·4 per cent. of infected fruit.

Table II. shows that black spot developed on all apple plots except Strathfieldsaye, the infection ranging from less than 1 per cent. to 8·2 per cent. The occurrence of black spot at Quantong (6·6 per cent. infection in Cleopatra and Rome Beauty) was of interest, as this district has been regarded by growers as practically free from black spot. Only one spray, the "green tip" Bordeaux mixture application, was used at Quantong, and it is probable that a more complete schedule will be required in future. No black spot infection was recorded in any of the northern district pear plots.

A certain amount of russet injury was recorded on several Jonathan apple plots, namely, Red Hill, Tyabb, Wantirna, Croydon, and Pakenham, in addition to the case of Panton Hill previously mentioned. At Red Hill and Tyabb approximately 5 per cent. of the fruit was rejected for russet due principally to the late application of the "green tip" Bordeaux mixture. The combination of arsenate of lead and lime-sulphur at Red Hill was also a contributory factor. With Jonathan apples in particular, it is important that the "green tip" spray be carefully timed according to the recommendations in order to minimize russet.

As a result of extensive lime-sulphur injury in 1936–37, the strengths of the spray mixtures were reduced for the 1937–38 season. This was justified by the higher polysulphide content of

modern lime-sulphur concentrates. Much less injury was reported in the past season, but owing to the great variation in polysulphide content of lime-sulphur concentrates above the prescribed minimum, occasional injury was reported. In order to ensure that growers obtain a uniform product, it is proposed to fix a minimum and maximum polysulphide and total sulphur content. This aspect was discussed by Mr. W. C. Robertson, Chemist, in the June issue of this Journal.

Applying the first lime sulphur spray at Pakenham Upper for control of black spot.

Chemical Bands.

The trees on fifteen of the twenty plots were bandaged with corrugated cardboard chemical (beta-naphthol-oil) bands which had been used successfully the previous season as a supplementary method of control. Three of the remaining plots were bandaged with bag bands, while the trees on two southern pear plots, where infection in the previous season was extremely low, were not banded at all.

Four proprietary brands and two home-made products were used on the plots, and these were supplied by the orchardists concerned. With three exceptions the bands were again found to be capable of destroying large numbers of larvae. The total number of larvae trapped on seven typical apple plots was 14,405, an average of almost nine per band. The number of larvae trapped per band on three typical pear plots was 4·5, the lower figure being due, principally, to the lower range of infection in pears than in apples. On plots such as Wantirna and Croydon, where the percentage of infected fruit or the number of infected fruit per tree was high, the higher. At Quantong 1,832 larvae were trapped number of larvae trapped was correspondingly in 88 bands, an average of 21 per band, and at Wantirna, 6,918 larvae were trapped in 364 bands, an average of 19 per band.

The beta-naphthol in properly made chemical bands so affects the larvae which enter them that they are unable to transform from the larval condition to the adult moth, and are finally killed. The efficiency of chemical bands can thus be measured by the percentage of moths which emerge from the bands. The average emergence of moths from normal effective bands on ten plots was 1·8 per cent., a figure in close agreement with that obtained in the previous season. The three exceptions referred to previously, occurred on the two plots at Tyabb and at Bamawm, and involved one proprietary brand, and one home-made product. These bands permitted at least 40 per cent. and 50 per cent. respectively, of the larvae which entered them to transform into adult moths.

Early in February when this condition was detected, the defective bands were dry and obviously deficient in beta-naphthol, whereas efficient bands were oily and contained a heavy coating of chemical within the corrugations. Samples were submitted to the Agricultural Research Chemist, who found that although unused samples of the defective bands had a satisfactory original content of beta-naphthol, the loss of beta-naphthol in these bands was very great after application to the trees. He concluded that the trouble was due to the use of oil of too light a grade during the manufacture of the bands.

In order to obtain the maximum benefit from chemical bands, it is necessary to eliminate as much alternative cover for larvae as is possible. This means that all loose bark on the tree, and rubbish around the trees must be removed. Early in February it became necessary to examine bands on many properties because of the defects reported earlier. During the course of these examinations it was noticed that these factors had been neglected in many cases and that the bands were frequently too loosely applied. In one instance where the bands had been applied loosely over rough bark, the number of larvae which had spun cocoons under the bark beneath

the band was equal to the number in the band. The emergence of moths from the bands was negligible, but 65 per cent. of the larvae situated under bark beneath the bands, but not in contact with them, transformed to adult moths. In cases where bands had been more carefully applied and loose bark removed, only 20 per cent. of the larvae were not in contact with the band, and only 20 per cent. of these had transformed to adult moths. The effectiveness of bands can therefore be greatly reduced by careless application and the failure to remove alternative cover.

Cost of Spray Materials.

During the season a record was kept of the quantities of spray material used on each plot so that the costs could be computed as in Tables IV. and V. The costs per gallon of mixed spray were as follow:—

Lime-sulphur ..	$2\frac{1}{4}$: 80 ..	0·41d.
Lime-sulphur ..	$1\frac{1}{2}$: 80 ..	0·27d.
Lime-sulphur ..	1 : 80 ..	0·18d.
Bordeaux mixture ..	6 : 4 : 40 ..	0·7d.
Bordeaux mixture ..	3 : 3 : 50 ..	0·3d.
Bordeaux mixture ..	1 : 1 : 50 ..	0·1d.
Arsenate of lead paste and spreader ..	5 : 80 ..	0·43d.
Arsenate of lead powder and spreader	$2\frac{1}{2}$: 80 ..	0·41d.
Summer white oil ..	1 : 60 ..	0·82d.

The costs of application, i.e., depreciation on plant and labour are not included, but are estimated at 2d. per tree per application.

TABLE IV.—COST OF SPRAY MATERIALS—APPLE PLOTS.

District.	Variety.	Spray Schedule.	Codling Moth Sprays.				Cost Black Spot Sprays.	Total Cost Spray Materials per Tree.
			Gallons per Tree (approximate).	Number of Lead Sprays.	Number of Oil Sprays.	Total Cost per Tree.		
						d.	*d.*	*d.*
Red Hill	Jonathan	A	2·5–3	5	..	4·8	5·1	9·9
	Jonathan	B		3	3	7·6	5·1	12·7
	Rome Beauty ..	A	1·5–2	6	..	2·1	5·0	7·1
	Rome Beauty ..	B		3	3	5·5	5·0	10·5
Tyabb	Jonathan	A	1·5–2	5	..	3·1	2·2	5·3
	Jonathan	B		3	2	4·7	2·2	6·9
Pakenham	Jonathan	A	1;5–2	4	..	2·7	2·7	5·4
	Jonathan	B		3	1	3·0	2·7	5·7
Wantirna	Jonathan	A	2·5–3	6	..	4·8	1·7	6·5
	Jonathan	B		3	5	10·4	1·7	12·1
Croydon	Jonathan	A	2·5	7	..	5·2	3·2	8·4
	Jonathan	B		3	3	8·5	3·2	11·7
	Democrat	A		7	..	5·2	3·2	8·4
	Democrat	B		3	4	10·7	3·2	13·9
Panton Hill ..	Jonathan	A	2·5–3·5	5	..	7·2	3·2	10·4
	Jonathan	B		2	3	11·9	3·2	15·1
	Rome Beauty ..	A		4	..	4·0	2·4	6·4
Batesford	Dunn's	A	1·5–2	6	..	5·5	2·4	7·9
	Dunn's	B		3	5	7·5	2·4	9·9
	Rome Beauty ..	A		6	..	4·1	2·0	6·1
Quantong	Cleopatra	B	1–1·25	6	3	12·2	0·8*	13·0
	Rome Beauty ..	B		6	4	12·5	0·9	13·4
	Rokewood	B		8	3	9·9	0·6	10·5
Strathfieldsaye ..	Granny Smith ..	B	2–2·5	2	7	14·3	2·1	16·4
Stanley	Granny Smith ..	A	3–4	3	..	5·1	3·9	9·0
	London Pippin ..	A		3	..	6·7	6·2	12·9
Harcourt	Dunn's	B	3	2	6	18·4	2·7	21·1

* One spray only applied—Bordeaux mixture, at "green tip" stage.

TABLE V.—COST OF SPRAY MATERIALS—PEAR PLOTS.

District.	Variety.	Codling Moth Sprays.			Total Costs of Black Spot Sprays.	Total Costs of Spray Material per Tree.
		Number of Sprays.	Gallons per Tree (approximate).	Cost per Tree.		
				d.	*d.*	*d.*
Tyabb	Packham	4*	2·5	4·8	1·8	6·6
	Beurré Bosc	4*	1·5	3·2	3·0	6·2
Burwood East	Packham	4	2·5	3·1	1·8	4·9
	Winter Nelis	4		4·0	2·0	6·0
Doncaster	Beurré Bosc	5	2·5–3	5·0	..	..
	Winter Nelis	7		6·4	..	..
	Josephine	7		6·4	..	..
Croydon	Beurré Bosc	5	2·5	5·2	3·4	8·6
Lancaster	W.B.C.	5	3·5	6·3	3·1	9·4
Ardmona	W.B.C.	5	6	13·2	6·0	19·2
Shepparton	W.B.C.	4	3	4·0	4·6	8·6
Bamawm	W.B.C.	4	3·5	5·3	1·9	7·2
	Beurré Bosc	4		5·1	3·6	8·7
	Winter Nelis	5		7·0	2·7	9·7
	Josephine	5		8·1	1·7	9·8
	Packham	5		6·0	2·7	8·7

* Including one application of summer white oil.

For the control of codling moth in Victoria, six to eight sprays may be required for apples, and four to six for pears. Arsenate of lead is the main insecticide used and is used almost exclusively for codling moth control in pears. For apples, however, the costs are increased by the use of summer white oil in the spray schedule. This is justified by the advantage of producing fruit free from arsenical residue thus eliminating the necessity for washing.

On those apple plots where both "A" and "B" schedules were demonstrated, namely, Red Hill, Tyabb, Pakenham, Wantirna, Croydon, Panton Hill and Batesford, the costs of spray materials for "B" schedule were from 2d. to 6d. per tree more than that for "A" schedule. This compares more than favorably with the cost of washing fruit, 2d. per bushel, provided the trees are carrying a normal crop. At Red Hill, for example, the extra cost of the "B" schedule for Rome Beauty trees was 3·4d. per tree, and the yield of fruit, three to four bushels per tree. At Croydon the increased cost of the "B" schedule was similar but the yield of fruit was only one to two bushels. The cost of controlling codling moth in a light crop is inevitably higher and the results less satisfactory than in normal crops, but control must be maintained to make it possible to produce a high percentage of uninfected fruit in a normal crop year.

Apart from variations in the quantity of spray mixture required per tree, the principal cause of variations in costs was the greater difficulty of codling moth control in some districts, particularly warm inland districts, such as Quantong, Pomonal, Harcourt, Strathfieldsaye, and the Goulburn Valley. The average number of sprays required for all southern apple plots was six, whereas the average for four inland apple districts was eight. At Stanley three sprays only were required.

Fertilizer Trials.

During the 1936–37 season 22 fertilizer trials were initiated on eighteen properties in conjunction with the apple and pear demonstration plots. Twenty-one of the trials comprised the following three treatments:—

1. No manure.
2. Ammonium sulphate—4 lb. per tree.
3. Complete manure (2 : 2 : 1)—5 lb. per tree.

The fertilizers were applied with the spring ploughing, about one month prior to bud-burst

An additional "Time of Application Trial" was conducted at Pakenham with a view to comparing the effects of applying 5 lb. of complete (2 : 2 : 1) manure per tree at various growth stages.

For the 1937–38 season it was found necessary to discontinue three fertilizer plots, namely Drouin, Geelong and Pomonal, the last because it was found impossible to arrange for the necessary yield records.

The results in the first season were in accordance with expectations, no significant effect on yield by any of the treatments being observed. In the second year, however, the application of 4 lb. of sulphate of ammonia on four blocks resulted in yields significantly higher than those of the corresponding unmanured plots. The blocks which gave the above responses were those at Lancaster and Bamawm (W.B.C. pears) and Wantirna and Red Hill (Jonathan apples). These responses so early in the history of these plots were rather surprising, but were probably connected with the level of fertility prevailing when the trials were initiated.

It is emphasized that work of this nature must proceed over a period of years before definite statements can be made concerning the value of the various treatments.

A group of interested growers at a field day on one of the demonstration plots.

Cool Storage Trials.

In 1937 supplies of fruit were obtained from certain apple plots and placed in cool storage to observe the effects of spray schedule, fertilizer treatment and district differences on storage qualities. The lay-out of the trials was as follows :—

Effect of Spray Schedule.—At Harcourt eighteen cases were picked from each of the spray schedules "A" and "B," while at Croydon, 36 cases were picked from each schedule. The latter sample was a composite of twelve cases from each fertilizer treatment.

Effect of Fertilizer Treatment.—This trial was conducted with two varieties, namely, Dunn's from Harcourt, and Jonathan from Croydon. From the former district, eighteen cases from each of the three manurial treatments, complete manure, ammonium sulphate and "no manure" formed the sample, while from the latter, 24 cases were picked from each manurial treatment, this being a composite sample of twelve cases from each spray schedule.

District Trial.—Eighteen cases of fruit were picked from the complete manure plots of schedule "A" in seven districts, namely, Red Hill, Tyabb, Pakenham, Wantirna, Croydon, Panton Hill and Harcourt.

For the above trials the fruit was picked, packed and wrapped as for export. The Jonathan samples were stored at 34° F. and the Dunn's samples at 32° to 33° F. The various samples were harvested over a period of approximately one month, from the 10th March to the 13th April, although it would have been preferable if the samples had all been picked in March.

The object of storing the Jonathan apples at 34° F. was to minimize the incidence of breakdown and scald which are low-temperature disorders, occurring most freely in fruit stored at 32° F., slightly at 34° F., and not at all at 36° F. At the higher temperatures, however, the storage life is reduced so that 34° F. was considered the optimum temperature. It was interesting, therefore, to find that in the samples of Jonathan apples drawn from seven districts, neither scald nor breakdown occurred in any appreciable degree until the storage life of the fruit was over. It should be noted that certain pre-storage factors are also important in the development of these disorders. Fruit picked in a normal year, towards the end of March, when maximum flavour and aroma have been developed, is more liable to scald and breakdown than fruit picked much earlier or later than this. Later-picked

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Phalaris Tuberosa makes tremendous growth in one year, growing 6 to 7 feet high, with nice succulent blades and flowering stems, and can be cut three to four times a year. The roots are fibrous and the foliage very dense and a bright green colour, especially during winter. Sow 2 lb. per acre in drills, or 4 lb. broadcasted. Seed can be sown throughout the year. In Government-sealed sacks, 4s. 6d. lb.

WHITE DUTCH CLOVER for sowing with *Phalaris Tuberosa*, 1s. 8d. lb.

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apples, however, have a short storage life, become mealy in store at an early date, and are more liable to Jonathan spot. The liability to scald is also greatly increased by placing warm apples at a temperature of 65° F. or more, direct into cool storage.

Jonathan spot developed more freely in the later-picked samples in these trials although that picked last, Panton Hill, developed no Jonathan spot at all. This disorder is favored by over-maturity and higher temperatures before and after storage. The end of storage life is marked principally by loss of flavour and finally by the onset of mould attack. In this respect August marked the end of the storage life of Jonathan apples in these trials except in the case of samples from Red Hill, Tyabb and Croydon, in which Jonathan spot developed freely after three months in store, i.e. when the storage life was over. This short storage life was due to over-maturity of the fruit at the time of storing, a factor which predisposed the fruit to Jonathan spot.

In the "effect of spray schedule" trial, fruit sprayed with white oil tended to show a higher precentage of Jonathan spot, but not until the storage life was over. There were no important differences as a result of the various fertilizer treatments. Since fertilizers have been applied for one season only, in these trials, it is probably too early to expect any positive results from this phase of the work.

Green Manure Crops.

During the autumn of 1937 an effort was made to establish green crops for ploughing in with the spring cultivation. Briefly, combined crops of peas and tick beans were sown on northern plots with oats and barley combined as additional trials. On southern plots, oats and barley were sown as the main crop with peas and beans as trials. Top-dressing trials with both superphosphate and sulphate of ammonia were conducted on both northern and southern plots. The crops were established generally by broadcasting the seed and manure by hand on the cultivated lands and harrowing or cultivating the seed in. The crops were sown over a period of approximately one month from 20th April to 25th May.

Conditions in 1937 were quite unfavourable for the early sowing and establishment of bulky green crops for ploughing in in the spring. A dry autumn was followed by a cold dry winter, and although a satisfactory germination of seed took place, the crops, with a few exceptions, failed to make any headway, and in some instances were complete failures. Very little information could be obtained to indicate the suitability or otherwise of the various treatments. Peas gave the most satisfactory crop on all plots but only at Geelong, Burwood East, Pomonal and Tyabb were the crops of sufficient bulk to be useful for green manuring purposes. The crops of oats and barley were a failure on all plots except Tyabb and Geelong, while beans were satisfactory at Tyabb only.

There were no marked responses in the top-dressing trials because of the unfavourable climatic conditions. Superphosphate gave slight responses where the natural herbage included leguminous species. With sulphate of ammonia there was a distinct response where there was any natural herbage, but again the effect was not very marked. The growth of herbage on areas which had received applications of sulphate of ammonia in the spring was slightly better than areas which had not received sulphate of ammonia.

RECOMMENDATIONS FOR 1938-39.

Full details of the Department's recommendations for the control of codling moth and black spot will be issued in the form of instructional circulars prior to the commencement of the next season. During the season the district orchard supervisors will issue appropriate spray advice per medium of local newspapers, circulars or notices posted in prominent places such as cool stores and packing sheds. Lure charts showing the number of codling moths trapped each week in lures on the demonstration plots will also be posted up for the guidance of growers. This system of advice will be supplemented by wireless spray forecasts details of which will appear in the instructional circulars.

Codling Moth.

The calyx or petal-fall application of lead arsenate is necessary to prevent infection of the fruit through the calyx and can only be effective if applied before the calyx closes. A thorough calyx spray ensures protection of this portion of the fruit throughout the season and should be regarded as a routine spray in all seasons and for all varieties of apple and pear.

For *apples*, apply at petal-fall, arsenate of lead 6 lb. of paste or 3 lb. of powder in 100 gallons of water. Two calyx sprays are recommended for varieties which blossom irregularly, e.g., Rome Beauty and Jonathan to ensure that the majority of the calyces are protected. In such cases apply

Apple blossom buds showing "green tip" stage. The bud scales have separated from the majority of the fruit buds and the tips of the green folded leaves are just visible.

the first spray before petal-fall has been completed (about 80 per cent. petal-fall), and the second seven to ten days later.

With *pears*, advantage is taken of the fact that the calyx closes slowly and can be more effectively filled with lead arsenate at a delayed stage. A suitable time is about three weeks after petal-fall but before the pears turn over and in combination with the third Bordeaux mixture normally required for controlling black spot of pears.

The times of application of cover sprays of lead arsenate or summer white oil sprays must be determined by the aid of lures in order to be most effective and to reduce the number of applications to a minimum. Growers are therefore advised to take advantage of the spray advice given during the season by the district orchard supervisor. In order to overcome the arsenical residue problem, particularly for apples which normally require an intensive spray programme, it is recommended that summer white oil, $1\frac{3}{4}$ gallons in 100 gallons of water, be used to replace arsenate of lead cover sprays late in the season. Arsenate of lead either alone or in combination with summer white oil should not be applied after December as otherwise the arsenical residue will certainly exceed the limit allowed.

Growers are warned not to apply white oil to the variety Cleopatra, particularly within two months of harvesting, unless previous experience has shown this to be a safe procedure.

The advantage to be gained from timing sprays largely will be lost if the application is not carried out thoroughly. Correct timing and thorough application of the sprays at the commencement of the season will enable better control of the first brood to be obtained and render control of later broods much less difficult.

White oil may be used for the control of the first brood quite as effectively as arsenate of lead and wherever this is practicable or desirable suitable advice will be given to growers in each district. The combination of arsenate of lead and white oil is known to be a most effective one for the control of codling moth but its use is necessarily restricted because of difficulty in removing the heavy arsenical residue resulting from its use. During next season the possibility of incorporating this valuable spray in codling moth spray schedules will be carefully examined from the point of view of overcoming spray injury and the arsenical residue problem.

The use of chemical or bag bandages is recommended as a simple and effective supplementary control measure. By trapping and destroying large numbers of larvae during the season the bands assist in the control of the late summer broods and substantially reduce the over-wintering population. During winter months all loose bark should be scraped from the butts and forks of the trees, the object being to detect and destroy

Showing—"early pink" stage of apple blossom.

as many larvae as possible. The removal of the bark is necessary to obtain the best results with bands.

The time at which larvae from the earliest infected fruit are likely to enter the bands will vary from district to district and from season to season. Bands should be in place during the latter part of November in all districts.

Packing sheds are a common source of infection because of the accumulation of infected fruit during the harvesting period and such fruit should be destroyed as soon as possible after rejection. Other common sources of trouble are tree props and the secondhand cases, used in the orchard, the crevices of which are frequently loaded with larvae. Such cases should be dipped for one minute in a boiling solution of 1 lb. of washing soda in 20 gallons of water.

Black Spot.

The time of application of black spot sprays is determined by reference to the stage of the developing buds on the tree. For the control of black spot the treatment is preventive rather than curative and for this purpose the fungicidal properties of copper, in the form of Bordeaux mixture, and sulphur, as lime-sulphur, are employed. The application of the sprays at the correct stages is essential both from the point of view of controlling the fungus and to minimize injury to foliage and fruit. Bordeaux mixture is the more efficient fungicide and is used wherever possible but, for apple varieties it is restricted to the earliest pre-blossom application except on certain varieties less liable to russet injury.

The "delayed green tip" stage of pears.

Pear blossom showing "finger" stage.

Apples.

The various stages of growth of apples at which sprays are applied are as follow:—

1. *Green Tip.*—This is recognized when the bud scales have separated from the majority of the fruit buds and the tips of the green folded leaves are just visible.
2. *Finger.*—The young green leaves have separated from the blossom buds which are beginning to separate in the cluster.
3. 5 *to* 10 *per cent. Blossom,* i.e., when this proportion of the flowers has opened.
4. *Petal-fall,* i.e., when the majority of the petals have fallen.
5. *Fourteen days after the petal-fall application.*

Bordeaux mixture 6 : 4 : 40 is always applied at the "green tip" stage and is then followed by a series of lime-sulphur sprays at stages 3, 4, and 5 above. The strength of these three sprays are in succession $2\frac{3}{4}$: 100, 2 : 100, and $1\frac{1}{4}$: 100. For varieties not liable to russet a second Bordeaux mixture spray 3 : 3 : 50 may be applied at the "finger" stage and the lime-sulphur sprays omitted. This latter schedule is not suitable for the Jonathan, London Pippin, Yates, Rokewood,

[*Continued on page* 416.

All-Australian Export Lamb Competition 1937-38.

Judge's Final Report

Following is the final report of the judge on the entries for the first series of the All-Australian Export Lamb Competitions conducted by the Australian Meat Board.

THE number of entries judged was 131 in Class I., and 9 in Class II., a total of 700 carcasses. The entries were made up as ollows :—

—	Class I.	Class II.	Total.
South Australia ..	59	..	59
Tasmania	34	1	35
Victoria	17	4	21
New South Wales ..	10	3	13
Western Australia ..	9	1	10
Queensland ..	2	..	2
	131	9	140

In Class I. the standard of quality was a high one, 72 of the 131 pens scoring 75 per cent. or more of the possible points. Of the remainder, 40 pens scored between 70 and 74 per cent., and there were 19 below 70 per cent., including 4 below 60 per cent. Two of the latter were from Victoria, and two from New South Wales, and none of these were considered up to Class I. standard.

The *Tasmanian* entries included the Grand Champion, and should be mentioned first. The winning entry (Messrs. N. S. and I. A. Badcock), were the only two pens in one entry to score each over 90 points, and the aggregate of 193 was a phenomenally high one.

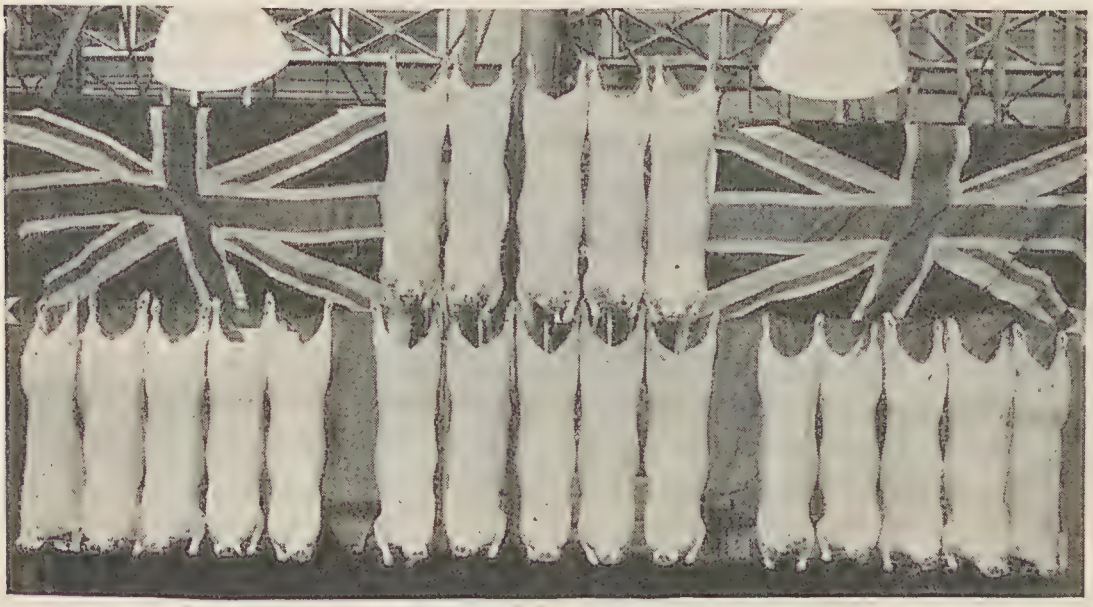
The average number of points scored by the Tasmanian entries was 78.8. The winning pens would no doubt have figured prominently in open competition and, apart from exceptional quality and conformation, were comprised of lambs at the light weights in most demand by the highest class retailers. (Entry No. 36, Tasmania, calls for special mention. The lambs were relegated to third place in the series because two of them lacked the necessary finish over the legs for show purposes, but from a trade point of view they were ideal. There are always buyers prepared to pay a premium for lambs of such excellent quality and light weight—28¾ lb. average).

Western Australia.—High as was the Tasmanian average of points scored, it was exceeded by the Western Australian entries with 80.5. There were, however, only nine entries (in Class I.) from Western Australia, so that the comparison is perhaps not a fair one. The highest number of points scored by a Western Australian entry was 94, in the case of Mr. B. D. Bothe's pen, No. 2, and five pens scored 80 or more.

Victoria.—Although a Victorian entry was successful in the Southdown Championship (and in Class II. also) the number of entries received from the State was disappointingly small and they were not up to the standard expected. The winners (Mr. E. C. Henry's pens, Nos. 9 and 12) were two outstandingly well-balanced pens, but these were a long way ahead of anything else from Victoria. The highest number of points scored was 92 (Mr. E. C. Henry's pen, No. 9) and the average for the State 75.6.

South Australia.—As regards number of entries combined with a high average, South Australia's was the most creditable performance. Entries totalled 59 (in Class I.) and the highest number of points scored was 90, with Mr. T. Ridgway's Pen, No. 17 (September). The average number of points scored by the South Australian entries was 74.9, and it was very noticeable that they were at their best in the early competitions and fell away later.

Queensland.—In point of fact Queensland has the highest average of points scored, viz., 90, but entries from that State were confined to Mr. Prentice's (Nos. 1 and 2). Mr. Prentice enjoys the distinction of having gained the highest number of points for a pen—96—with the single exception of the Grand Champion (first pen), and of demonstrating that, under certain circumstances, export lambs can be produced in Queens-



Tasmanian lambs—a section of the Competition exhibit.

land as well as anywhere else in Australia or, for that matter, other countries which export lambs to the United Kingdom.

In competitions, where a high standard was set and only eight of the 131 entries (in Class I.) scored 90 points or more, it is very gratifying to find that each State contributed a pen to this distinguished list. The following is the list:—

N. S. and I. A. Badcock (No. 1), Tasmania	98
F. Prentice (No. 1), Queensland	96
N.S. and I. A. Badcock (No. 2), Tasmania	95
B. D. Bothe (No. 2), Western Australia	94
*A. J. Archie and Son (No. 36), Tasmania	94
E. C. Henry (No. 9), Victoria	92
T. Ridgway (No. 17), South Australia	90
*Memsie Pastoral Co. (No. 2), New South Wales	90

* Only one pen entered.

Class II.

Entries in this Class were disappointing as regards numbers, totalling only nine in all, and, in fact, only two competitors submitted the required number of pens to be eligible for the prize. The prize went to Messrs. E. and B. Hawkins, Victoria, but the Longerenong Agricultural College, Victoria, entered the pen which scored the highest number of points—82. The five leading pens (Messrs. E. and B. Hawkins (2), Agricultural High School, New South Wales, and Longerenong College) were good commercial types, but contrasted very unfavourably with the Southdown Class.

Breeding Ewes.

No definite conclusions could be drawn from the results of the competitions with regard to the suitability of breeding ewes. The contrast between the entries in Class I. and Class II., however, was so marked that it seems possible that at least in many districts the Southdown ram can be used to advantage to cross with any of the ewes available and produce a more or less improved type of export lamb. Obviously where it is possible to select ewes for type, the best results should follow.

General.

The displays of the competition lambs created a great amount of interest and no doubt revealed to retailers that each State is capable of producing the ideal type of carcass. There still lingers a prejudice in the minds of a section of the trade, but displays of lambs comparable to any from other countries can be relied on to further remove this prejudice.

Visitors from the provinces were particularly impressed, and it may confidently be expected that

early shipments of Australian Down type lambs will be more eagerly sought. In several instances retailers who made purchases of the competition lambs remarked on the wealth of meat to bone and on the pale and attractive appearance of the flesh, which gave entire satisfaction to their customers.

It is recognized, of course, that lambs of Class II. represent the bulk of Australia's exports, and that it is of the utmost importance that these should not be in any way overlooked. It is the Down type, however, which is demanded, and one object which the competitions achieved was to demonstrate that this type is being developed in Australia with marked success. The trade can safely be relied on to note the improvement in the Class II. type of lambs, but the development of the Down type is one which can profitably be advertised.

Butter Production and Export

The following table shows:—

(*a*) Factory production of butter and cheese in Victoria for the period July, 1937, to May, 1938, compared with the corresponding period of 1936–37; and

(*b*) Quantities and percentages of various grades of bulk butter examined in Victoria for export from 1st July, 1937, to 30th June, 1938, in comparison with the corresponding period of 1936–37.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1937–38.	1936–37.	1937–38.	1936–37.
July to April	56,530	61,886	6,655	5,288
May	2,496	2,814	295	297
Totals, eleven months	59,026	64,700	6,950	5,585

BULK BUTTER EXAMINED IN VICTORIA FOR EXPORT (QUANTITIES IN TONS).

Period.	1937–38. How Graded—				Total.	Period.	1936–37. How Graded—				Total.
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
1st July to 28th May	22,595	9,012	2,139	104	33,850	1st July to 29th May	27,264	9,167	2,662	438	39,531
29th May to 30th June	32	41	41	1	115	30th May to 30th June	18	10	29	2	59
Totals 1st July to 30th June ..	22,627	9,053	2,180	105	33,965	Totals 1st July to 30th June ..	27,282	9,177	2,691	440	39,590
Percentages ..	66·6	26·7	6·4	0·3	..	Percentages ..	68·9	23·2	6·8	1·1	..

Grading of Cream

Causes and Remedial Measures

A country butter factory in attractive surroundings.

ANY industry which exports its product must do so in the face of extremely severe competition. This certainly applies to our Australian butter, and had we all the advantages of our chief competitor it would be difficult enough. Without them we are given no alternative but to apply the utmost possible human efficiency. Only by superior or at least equal precautions against the entry and development of the common destroyers—micro-organisms—will butter at two months' old compare with what it was at two days' old. Yet this is the exporting butter-makers' unceasing obligation; the bloom and flavour of new butter must be preserved. It calls for the utmost care in all phases of its manufacture. The more hands and processes a perishable commodity has to pass through the greater the danger of contamination. At best, butter comes to us through a cowshed and dairy as well as a factory with all the possibilities of personal, atmospheric, and mechanical contamination that this implies.

Now, though we know that an incompetent factory manager may manufacture inferior butter from good cream, none, however clever, can make a sound butter of unsound cream; so the first and most important step in improving the quality of our butter is to make sure of a good cream

Dairy buildings showing free circulation of air between milk room and cowshed.

A very satisfactory arrangement on this property is that the feed shed is detached from the cowshed, making the latter sanitary and clean. When building a new cowshed consider retaining the old one for feeding purposes.

supply, that is, cream that is clean in both its substance and its flavour. In the production of such, we must remember that cream is altered only by what is permitted to enter it, and this means little other than germs, so small that we do not see them, but which will soon prove their presence by their effect if allowed to enter in undue numbers. Quality in cream is almost entirely a matter of germ-content, and it is the duty of all concerned to try to keep this content down at all costs.

The necessity for care starts from the time the milk emerges from the udder and continues through every stage of treatment and manufacture. It involves consideration of cleanliness all the time—cleanliness of person, cows, atmosphere, utensils, buildings, floors, drains, and everything else that bears on germ growth and conveyance. Through the channels the produce must travel, there are many points at which contamination may take place, and many ways in which it may occur; and one weakness at any stage of production may cause unremediable damage. The first and very important point in the production of choice butter is to provide the factory manager with choice cream. The following remarks are intended to deal with this phase of the work.

In order to prevent contamination it is first necessary to be aware of the causes and the steps which may be taken to prevent them. The main taints or faults in cream may be classified as follows:—Those caused by absorption, fodder taints, chemical flavours, metallic taints and bacterial taints.

Absorption.—Cream and milk readily absorb odours from the surrounding atmosphere and flavours from articles with which they are brought into contact. The proximity to the dairy buildings of pigsties, calf pens, dog kennels, stables, or fowl houses may impart very undesirable odours. Storing cream in a room containing odoriferous articles, such as kerosene, onions, manures, meat, or fruit; the proximity of an oil engine, smoke from a copper, the carting of cream or milk in the same vehicle used for the cartage of pigs or calves, all invite tainting by absorption.

Fodder taints are met with when cows graze on lucerne, rape, strong growths of trefoils and clovers or melilotus. The same trouble arises if they are fed on turnips or cabbages, or if they eat scrub, various weeds, or herbs. If stock have access to stagnant strong smelling water, a taint will develop also.

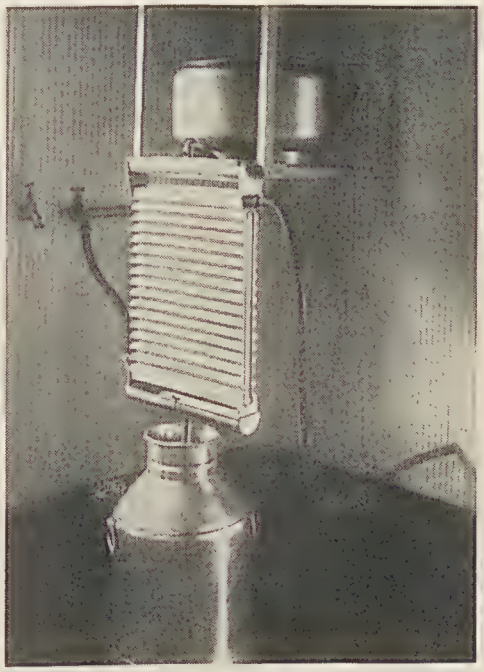
Chemical flavours.—The most common cause of chemical flavours is the use of odorous ointment on the teats. Other causes are the drenching of cows with certain drugs, the tarring of cowsheds, or the use of certain chemical germicides in the milk.

Metallic taints—caused by the use of utensils from which the tin has been worn. The base metal, copper or iron, thus comes into contact with the milk. Rusty utensils, such as buckets, cans, separator, dishes, and coolers from which the tin is worn are the chief offenders. No method of treatment can rid the cream of this taint.

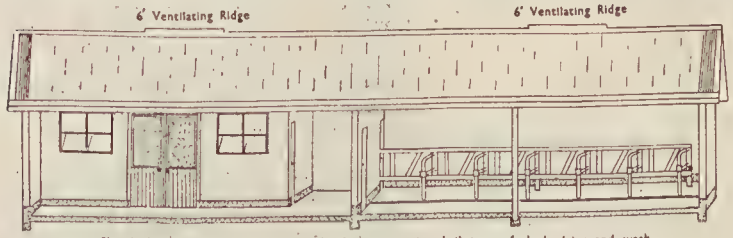
Bacterial taints are the most difficult of all to combat. The germs which attack and decompose

milk may be either bacteria, yeasts or moulds, and are the lowest form of plant life—that is if they can really be classed as plants. They are so small that they can be seen only by the use of a microscope, and placed end to end it would take 25,000 of the ordinary rod-shaped bacteria to measure 1 inch. Millions of these micro-organisms may be contained in one drop of contaminated milk. They reproduce themselves by a simple process, the cell becomes elongated and a partition forms across the middle. The two cells thus formed, separate and form two bacteria. Higher plants may take weeks, months, or even years to mature. These simple plants may complete their growth and reproduce themselves in 30 minutes.

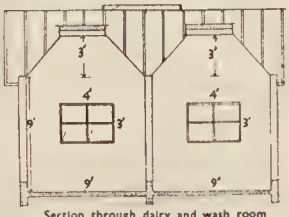
Germs are present almost everywhere in the atmosphere, so there is a possibility of many kinds of bacteria being found in milk. They may include pathogenic (disease causing) organisms from the cow or from persons handling the milk who are affected with diseases of various kinds. Dust in the air is laden with germs; that from the cowshed with many harmful ones. Germs also enter the milk from the milkers' hands and clothes; from the cows' udders, teats, and flanks. Flies are a fruitful source of contamination. Even one fly may carry millions of organisms. Water left in badly washed cans, particles of milk and filth in open seamed utensils and unwashed separators, all form favorable breeding grounds and prolific sources of contamination for milk in



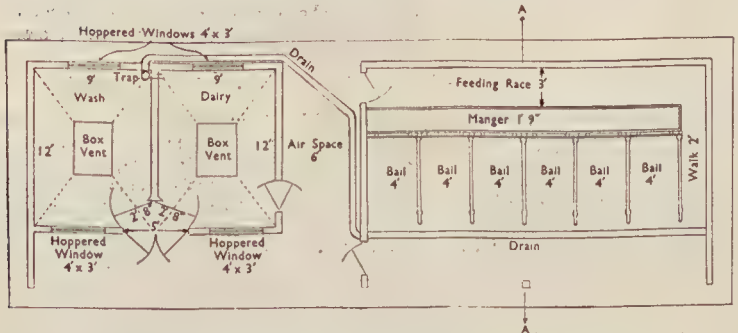
A hygienic milk room showing concrete base and neat lining of fine corrugated iron.



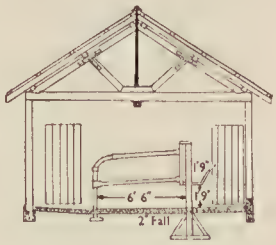
Sketched elevation of a compact and attractive section bail type of shed, dairy and wash rooms which may be constructed of concrete or bricks or weatherboard, galvanized iron or fibro-sheet on dwarf concrete wall as indicated.



Section through dairy and wash room showing full-coved ceiling ventilated through box vent to roof space and thence away by ventilated ridge.



Plan of return bail shed with attractive and convenient arrangement of dairy and wash rooms. Access to feed room to be provided at suitable point in rear wall or preferably on end of shed furthest from dairy.



Section through cow shed at A-A showing bail construction and floor drainage.

Sketch of a satisfactory type of milking shed, dairy, and wash room.

which most types of organisms increase rapidly. There is a notable exception in the case of the *Bacillus tuberculosis* which, while it will live in milk, does not multiply in that medium.

Temperature plays an important part in relation to the development of bacteria in milk. At blood heat, or that at which the milk comes from the cow, putrefactive organisms operate and increase quickly. By reducing the temperature, we lessen their activity and render conditions more favorable for the operation of the lactic acid type which will hold the putrefactive ones in check. Most organisms will thrive best at a temperature of 80° to 90° Fahr., but 60° to 70° Fahr. is a favorable range for the growth of lactic acid producing bacteria, and at this temperature the latter are able to prevent the development or increase of the undesirable forms. The lactic acid type of organism which breaks down the lactose or milk sugar causes the cream to sour and ripen, and besides checking the growth of objectionable organisms, plays an important part in the flavour and keeping qualities of butter.

The meaning of grades shown on factory receipts, their probable cause and the necessary remedial measures, are shown in the following table :—

Why Graded.	Probable Cause.	Remedial Measures.
Dirty dishcloth flavour, sometimes described as **off-flavour** (Flavour and smell of dirty soiled cloth)	The use of dirty soiled cloths in the washing of utensils or cows' udders and teats	Use clean brushes for utensils, discard cloths—wash and boil cloths used for cows' udders and teats after each milking. Avoid dirty cloths—after washing ring well, shake out, and hang in clean position to dry
Unclean flavour, disagreeable odour, faecal taint (Unpleasant, disagreeable taste, objectionable odour)	Failure to wash and sterilize separator twice daily, unclean utensils, dirty milking machines, cows' udders, and teats not thoroughly washed, or dirty surroundings	Wash separator and utensils immediately after using, rinse well with lukewarm water, then wash thoroughly with hot water and washing soda, using a brush vigorously. Rinse with hot water to remove all soda water, then sterilize by immersing in boiling water or exposing to steam under pressure for five minutes. Keep sheds, dairy, and yards clean. Do not allow manure to accumulate, but remove it daily well away from the shed. Remove milk from cow shed immediately it is drawn, protect it from flies and dust. Use dairy for storage of milk and cream only. Do not allow dirty casks or cans of sour skim milk to stand in the separator room, do not flush the separator with hot water as this carries slime into the cream, use a little separated milk. Where the dairy or separator room is close to the cow shed a separate cream storage should be provided in a cool shady place with clean atmosphere. Wash all dirt from udders and teat apertures before milking.
Cowy flavour .. .. .. (Cream possessing animal taint or odours from cow yard)	Cow manure, dust, or liquid getting into milk or cream, dirty leg ropes, dirty milking stools, failure to cleanse udders, or milkers failing to wash hands. Delay in removing milk from shed, separator too close to cow shed	Udder and flank on milking side to be clipped, flank and under body to be brushed, and udder to be washed before milking. Hands to be washed before milking each cow, do not milk with wet hands. Provide concrete bailing yard, also concrete floors in shed and dairy, making provison for drainage. Keep yards and shed clean, remove manure daily. Wash out separator room with clean water after use, not with the water in which the utensils have been washed. Keep leg ropes and stools clean, do not handle them after having washed your hands. Have separator room detached from shed

The meaning of grades shown on factory receipts, etc.—*continued.*

Why Graded.	Probable Cause.	Remedial Measures.
Milking machine taints .. .. (Objectionable flavour of dirty fat and fat saturated rubber)	Milking machine pipe lines and claws not being thoroughly washed and sterilized every time after use—faulty perished rubbers, leaking inflations, dirty airline	Do not use rubber tubing that has become perished and spongy, renew inflations frequently, do not wait till they are cracking, watch all rubber connexions and tubing carefully, keep free from grease and dirt. Wash machines immediately after use—first cleanse exterior of cups carefully with warm water and brush, then draw luke warm water through each set of cups, to be followed with hot water and soda (one tablespoonful of caustic soda to four gallons hot water), then flush with boiling water to remove the soda water, afterwards steam for five minutes, using steam at a pressure of not less than 10 lb. Claws, teat cups, and rubbers should be removed and taken to troughs where they can be carefully washed and sterilized. When not in use they should not be left hanging in cow shed exposed to flies and dust. Pipes should be uncoupled frequently and all joints cleansed. Air lines must be cleansed and sterilized similarly to milk pipes
Cheesy flavour .. .. (Cream having a flavour resembling cheese)	Mixing hot cream with cold, failing to cool cream direct from separator, keeping cream too long before delivery	Hot cream should never be separated into cold cream. It should be cooled over a water circulation cooler as it runs from the separator so as to aerate and reduce the temperature, and be mixed with the cream from previous milking some hours later. Stir at least twice daily with a well-tinned metal plunger, do not use sticks, they are absorbent and become contaminated. Wash stirrer after use, do not leave it standing in cream. Cream should be delivered to factory frequently, do not hold it until it becomes stale
Feedy fodder taint .. .. (Possessing rank or weedy flavour)	Rank growth of grasses, clovers, lucerne, trefoil, rape, capeweed, cabbages, turnips, strong-flavoured herbs, scrub leaves, &c.	To minimize this type of feed taint turn cows on to the pastures which cause the trouble immediately after milking, but remove them three to four hours before milking again. Avoid the use of certain foods which cause taints, but, if they must be fed, endeavour to do so after milking, so that some hours may elapse before the next milking. Cooling cream aerates it and allows the fodder odour to pass off. This applies to milk also
Metallic flavour .. .. (Possessing a metallic flavour)	Use of coolers, buckets, cans, and separator bowls from which the tin has been worn, thus allowing the milk and cream to come into contact with the base metal	Use only well tinned vessels with carefully floated seams. Do not use any dairy utensil, separator, or cooler from which the tin is worn. When rust spots are noticeable the article concerned should be retinned or discarded at once. Stainless steel is the ideal metal for dairy use, but unfortunately its present high price places it out of reach of most farmers for cans and buckets

The meaning of grades shown on factory receipts, etc.—*continued.*

Why Graded.	Probable Cause.	Remedial Measures.
Musty or mouldy flavour .. (Musty or mouldy taste and odour)	Usually an absorbed flavour caused when milk or cream is stored in cellars, dark, musty rooms, or in coolgardie safes when hessian is old and mouldy. Feeding musty hay or chaff in the cow shed. Failure of milkers to wash hands after handling musty hay or chaff. Mould spores from old manure heaps blowing into the milk	Store cream in a clean, airy room with sweet atmosphere. Avoid storage in cellar or badly ventilated rooms, or coolgardie safes when the hessian is old and mouldy. Do not feed mouldy chaff in cow shed. Do not use dairy as storeroom for other goods. Do not hold cream too long and allow it to become stale before sending it to the factory. Manure heaps should be a long way from the cow shed
Yeasty fermentation .. .. (Cream rising from can as if yeast had been added—foamy)	Gas forming organisms or dust from feed or manure gaining access to milk. Failure to hold cream at a sufficiently low temperature. Retaining cream too long on premises, failure to wash and sterilize utensils. It is frequently an indication of lack of boiling water	Wash and sterilize all utensils and cans. Yeasts are easily destroyed with boiling water. Cool cream and store in a cool position, deliver frequently to factory. Wash udders and teats of cows before milking, do not place utensils where dust or flies may settle on them, do not store in warm, badly ventilated rooms
Oil and petrol fumes taint .. (Cream impregnated with fumes of petrol or oil)	Engine in separator room. Using water from engine hopper to wash utensils. Fumes from exhaust blowing into separator room	Partition engine off from separator room. Take precautions to prevent fumes from exhaust pipe entering separator room, do not make use of water in oil engine hopper for cleansing utensils. Use spindle drive and avoid belt holes in wall of separator room.
Chemical taint .. .. (Chemical taste or chemical odour)	Odorous ointment, such as carbolic or others of that type, or milk from cows that have been drenched with chemical mixtures. Freshly tarred cow sheds, using soap for washing udders	Do not use odoriferous ointment on cows' teats. Use odourless ointment only (if at all), and do so after milking. Wash hands thoroughly with warm water before milking a cow after handling ointment. Try to avoid milking cows in freshly tarred premises until the odour of coal tar has disappeared. Do not use soap on udders
Ropy .. .. (Cream drawing out into threads like treacle, or slimy)	Organisms that are frequently present in water from lagoons, stagnant waterholes and dams. Cows wade in the affected water and convey the organisms to cow shed on tails, legs, teats, udder, and under parts of body. Using the contaminated water to wash utensils or cows' udders and teats. Use of fouled cloths to cleanse udders	Prevent cows wading in water which may be contaminated by the organisms causing ropiness. Muddy crossings in water channels should be fenced off, or culverts or dry crossings provided. Boil all water used for washing cows' udders and milkers' hands, do not allow them to come in contact with unboiled water after they have been cleansed. Sterilize all utensils by immersion in boiling water or exposure to steam under pressure for five minutes
Sickly taste .. .. .. (Nasty sickly flavour)	Ill health, fevered condition of cows. Over-milking with machines	Do not use milk from cows showing signs of ill health, or from cows that are in a fevered condition. Remove cups immediately cow is milked. Avoid using excessive vacuum

The meaning of grades shown on factory receipts, etc.—*continued.*

Why Graded.	Probable Cause.	Remedial Measures.
Beastings. Sometimes described as **albuminous** (Smell and taste of beastings)	Using milk from newly calved cows	Do not use milk for four or five days after calving. A simple test is to boil a cup of milk, if it will not boil without thickening it is not fit for use. Beastings milk put through the separator will spoil a whole can of cream, it cannot be made into good butter
Swampy .. .. .. (Strong smell and taste of swamps)	The use of swamp or lagoon water for the washing of utensils or cows' udders. Pastures that have been recently flooded. Cows drinking stagnant, strong smelling water which contains decaying vegetable matter	Have a good supply of rain water conserved at dairy and shed, or clear running water for washing purposes. Provide cows with good clean supply of drinking water. If on pasture that has been flooded endeavour to remove cows to other paddocks until the grass has been washed clean by a good shower of rain
Curdy .. .. .. (Cream coagulated and showing white particles of curd)	Cream too thin, and if the weather is warm the excess milk sours and coagulates quickly. Screw not adjusted correctly. Not turning at correct speed, milk at too low a temperature when being separated	Adjust the separator screw to skim thicker and produce a cream containing approximately 40 per cent. butter-fat. Turn separator at correct speed. Have milk at correct temperature for separating (90° F. to 98° F.); cold milk means thin cream and butter-fat lost in the separated milk
Salty taste, slight bitterness .. (A salt taste accompanied sometimes with a bitter flavour)	Advanced lactation period of cows. Usually met with in autumn and early winter when cows are drying off	As this trouble is usually caused by milk from cows that have been milking for a considerable time, examine the milk from each animal and discard that detected as the cause of trouble. Such cows should be dried off immediately. Do not use milk from once-a-day milkings.
Bitter .. .. (A disagreeable bitter flavour)	Usually met with when cream is held too long during winter, when the supply is small and the cream is kept for several days in the cold weather. Certain weeds or herbs	Deliver cream more frequently to factory. If trouble does not then disappear test milk from cows individually, there may be one particular offender. Weeds in the pasture may be the cause, removal of cows to other pasture for a short period may be necessary. Maintain cream at 65° F. in storage if weather is colder
Soda flavour. Sometimes **slimy** .. (Tasting like over-neutralized cream. Sometimes sliminess is noticeable)	Milk from cows suffering from mastitis or other udder trouble	Examine the cows for mastitis by a close handling of the udder for swelling or inflammation. Place a piece of black smooth cloth over a small vessel, milk the first few jets of milk from each quarter through the cloth. Discard all cows whose milk shows signs of clots or blood, also any cows whose milk is watery or abnormal in any way

The meaning of grades shown on factory receipts, etc—*continued.*

Why Graded.	Probable Cause.	Remedial Measures.
Tallowy .. .. .. (A tallowy fatty taste)	Mixing hot and cold cream. Failing to cool milk direct from separator. Holding at too high a temperature. Exposing cream to direct sunlight. Allowing cans containing cream to stand in the sun. Coming in contact with the base metal of utensils or any part of equipment from which the tin has been worn	Cool cream direct from separator. Never mix hot and cold cream. Do not expose cream to direct sunlight, nor allow cans containing cream to stand in sun where cream has to be left by the side of the road for pick up carts. Roofed stands should be provided to protect cream from sun and weather. Covers must be provided by all carriers to protect cream or milk from sun. Have your storage for cream as cool as possible. Do not use cans, buckets, or any equipment from which the tin has been worn, allowing the milk or cream to come into contact with the base metal
Fishy .. .. (Unpleasant fishy flavour)	Usually of bacterial origin. Organisms responsible are frequently found in water, and give trouble where the utensils are not sterilized or where the contaminated water is used for washing cows' udders and teats. Sometimes troubles of the udder may give rise to the taint. Rusty utensils	Have water supply examined; if contaminated avoid use. Boil all water used for washing cows' udders. Do not use soiled cloths. Examine cows for signs of udder trouble, test milk from each. Use only well tinned vessels, sterilize thoroughly by immersing in bubbling boiling water, or subjecting to steam under pressure for five minutes. Make sure they are dry. Use stainless steel separator discs.

Three essential factors in the production of choice cream are—**Clean premises—Clean utensils—Clean methods.**

In the production of choicest cream and the maintenance of a healthy herd a shed which admits plenty of light and fresh air is an important factor.

The milking shed should be as free from contamination by dust as possible.

Milk Quality

By J. M. Kerr, Superintendent of Dairying

THE word "quality", as applied to milk, conveys, perhaps, a different idea to different people. Some will interpret it as referring to the cream or butter-fat content—a matter of the essential milk constituents. Others will deem it to have reference to the milk's keeping-properties which is really a matter of its bacteria content. Of course, a milk may be of poor quality as far as the amount of its fatty or non-fatty solids is concerned and yet be quite a good milk as regards its freedom from bacterial change or decomposition. On the other hand, a milk may be of a very high quality as judged by its butter-fat test, and yet be of a very poor quality when measured by its actual or prospective deterioration from bacterial causes. Quality of milk is, in either case, a matter of the milk solids and may have relation either to their proportion or to their degree of preservation.

If the defect is in the amount or proportion of the solids, it may be from either the innate nature of the cow's secretion, from the deficiency of greeness in the feeding material, or from human tampering with the article after production. If the impairment is one of chemical change, amounting to, or in the direction of, physical decay or decomposition, it will almost invariably be found to be the result of bacterial or germ action. For all practical purposes we can name germs as the direct cause of all those changes in milk which cause us to regard it as "not keeping".

The spoiling process is essentially progressive and germs are responsible from beginning to end. Immediately they obtain entry into the milk these germs convert the lactose into lactic acid. As the germs breed, so does the acid-product increase, and when the acid-development has increased to about .7 per cent. of the

total milk, curdling results, and it is not long before all the milk has become thick. Once germs enter milk they have there practically everything they require in the way of food and breeding facilities, and the only safe plan is for the dairyman to guard against the entry of micro-organisms into the milk in the first place. This precaution must be observed not only at particular seasons but also every day in the year.

It is best accomplished by protecting the milk at all stages from dirt in any form. Dirt is the germs' best vehicle, and constitutes their only means of entry. It is certainly not easy to keep germs out of milk if the cows udders and teats are carrying mud as they so frequently do in the winter; or a coat of green manure, as they are apt to in the spring; or when the manure, as dust, is being carried right into the cowshed by severe drying winds in summer Dirty hands on the part of the milker, and untrimmed hair round the teats of the cows both play their part in introducing dirt and germs into the milk.

Germs that are not killed in the washing of a utensil are there in wait for the next milking. If the final heat applied is not sufficient to ensure complete and speedy drying of the utensil, the germs will multiply rapidly. A moist surface on any utensil enables a germ to persist and multiply, but the milky-natured moisture of an ill-cleansed dairy utensil makes possible a reproduction or multiplication rate almost as speedy as if in the milk itself. In regard to utensils stored after washing, anything short of a bone-dry condition condemns the owner as a dairyman. The dryness should be achieved solely by the agency of heat.

Milk, of course, comes from the cow at blood-heat—a very favourable temperature for the propagation of germ life. Having taken all practicable steps by the utmost cleanliness to keep the initial germ-content of the milk down to small numbers, the dairyman's second line of defence is to cool the milk as far, and as early, as possible. The cooler that one can make, and keep, the milk the better. As hot weather is more conducive than cold to the growth of bacteria, one can understand why excessive bacteria-counts are most common in summer, and why milk does not keep so well in muggy or thundery weather.

In milking sheds that have the receiving yard on the northern or north-western side, it is difficult to keep germs out of the milk pails during the summer, when hot drying north winds prevail. The manure on the yard surface having dried into dust is lifted by these winds and blown into the bail atmosphere, making a heavy initial infestation of germs almost a certainty. Much depends on the regular sweeping of the yards in such circumstances for, of course, manure should not be allowed to accumulate anywhere near a cowshed, much less where the prevailing winds are certain to blow it towards the cow bails.

If manure-dust were the only contaminating agent to be considered, the receiving yard should never be placed on any other side of the milking shed but the eastern. Even more important, however, than the direction of the prevailing winds, is the direction of the yard drainings. The cows should enter the milking shed not from the highest side, but preferably from the lowest, and if the latter is not situated on the east, the favourable eastern position for the receiving yard must be foregone in the interests of better drainage.

Another form of germ infection associated with season is that of ropy milk, which almost invariably confines itself to the late summer and early autumn. This is so for two reasons. Firstly the causative germ flourishes only in water that is more or less stagnant or stale, and secondly, not only are cows more tempted to graze about stagnant water in the dry season, but also the same dry conditions tend to make water courses more stagnant.

This is often accentuated in case of a heavy summer rain lodging in swampy hollows, and which warms up before it diminishes by evaporation. When the organism of ropy milk gets on to a cow's teats and udder, it is but a step further into the milk bucket. The effect of this organism is to cause the milk to become stringy or ropy so that it will adhere to anything dipped into it, and be drawn out into long threads when the article is lifted from the milk.

A condition which must not be confused with ropy milk is the somewhat similar stickiness due to mastitis, a disease of the udder. This, of course, is not seasonal, but is likely to occur at any time.

There is still another condition not unlike ropy milk and sometimes mistaken for it: this is a stickiness or sliminess in the milk, due to the inclusion of milk from cows too nearly dry, especially (as is often the case), if such cows are being milked less frequently than twice a day.

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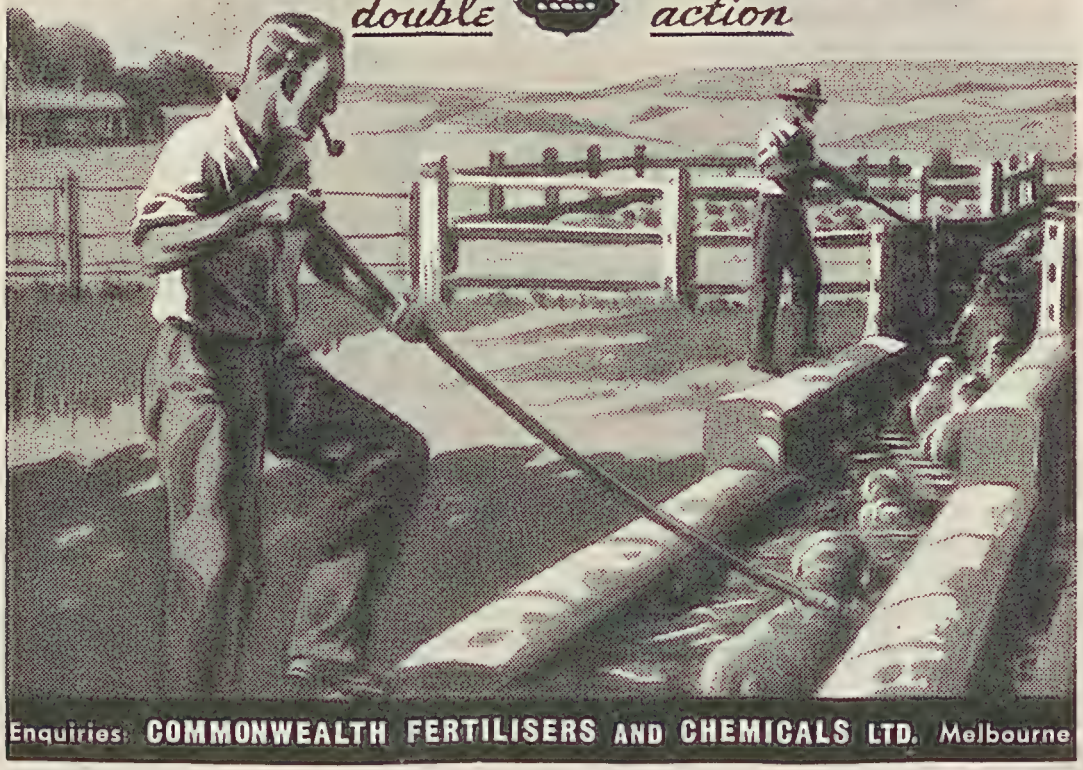

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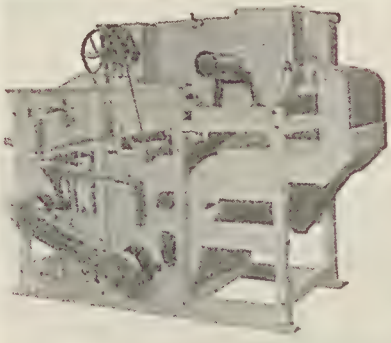

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Arsenical Poisoning of Stock

By R. N. Wardle, B.V.Sc., Veterinary Officer

ARSENIC is by far the most common of mineral poisons met with in veterinary practice. It is a metallic chemical element which, in combination with other chemical substances, forms compounds used commercially for many purposes; and in a subject such as this, the reference to arsenic includes all these compounds. In practically all its forms it is poisonous to stock, the potency being greatest in the most soluble compounds. Veterinary practitioners are called on frequently to treat cases of this poisoning in the different animals with which they come in contact.

Investigations conducted by officers of the Department of Agriculture show that cases of arsenical poisoning occur in all parts of the State, and although, particularly when there is mortality, it is rather easy to make a diagnosis, the source of the poison is not always discoverable. Cattle and sheep are the animals most often poisoned, and occasionally there are cases in pigs, horses, and dogs.

Arsenic compounds are universally used for a varying number of utilitarian purposes. Some medicines contain this drug, and overdosing may result in poisoning. Many sheep dips and weed killers contain arsenic in some form, in such strength that quite small amounts will prove fatal to stock. It is also an ingredient of certain pigments used in paint manufacture, of certain wood preservative lotions, and of spraying mixtures and baits used in orchard and garden husbandry. Small quantities of arsenic are found in chimney fumes, and after many years the bricks and mortar become impregnated with the poison. Then mention must be made of the fact that arsenic compounds, for various reasons, are popular in cases of deliberate poisoning.

Arsenic poisoning in cattle can often be traced to the fact that those animals, whose diet contains insufficient quantities of certain essential minerals, the chief of which is phosphoric acid, develop a depraved appetite; this depravity causes them to chew and lick all manner of foreign material. If they are unable to obtain bones and carcass material, they will chew and lick chemicals, paint, wood, bricks, mortar, and metallic objects; and analyses of many objects of rubbish tips may confirm the presence of arsenic. To correct this depraved appetite, a mineral food supplement containing bone flour or dicalcic phosphate should be made available to stock, particularly to growing cattle and milking cows.

Another fairly common cause of cattle poisoning by arsenic is the ingestion of herbage which has been treated with a weed killer or orchard spray. The poison will remain potent for a considerable period, and it should be kept in mind that herbage so treated is not unpalatable to stock. Care must also be exercised in regard to stock drinking from pools of water adjacent to treated herbage, as rain may have washed some of the poison from the treated area into the water catchment. Cattle as well as sheep have been known to become poisoned after eating grass on to which sheep, still wet from dipping, have been depastured. And finally mortality has at times been traced to sprays and baits used to combat grasshopper invasions.

Arsenical Sheep Dips.

As arsenical sheep dips are used very widely, and never a season goes past without several reports of deaths from this source, brief mention will be made of some advice in connexion with the use and misuse of these compounds. It should be borne in mind that one is dealing with a powerful poison, and consequently every care must be taken with its storage; any packets of the powder form or drums of the liquid should be kept in a place accessible only to responsible persons. Cases of poisoning have occurred where a dismissed employee has mixed dipping material with stock feed or with drinking water with a consequent loss of numerous head of stock.

In mixing a dip, the instructions given by the manufacturers should be carried out implicitly, and containers with any contents remaining should never be left in a place accessible to animals; further, once a container has held an arsenical preparation, it should never be used for water storage. Sheep should not be dipped when thirsty, as some, particularly lambs, may drink sufficient of the dipping fluid to cause

poisoning. It is advisable to dip lambs separately as the mature sheep may cause some of the lambs to be submerged too long with a consequent accidental swallowing of the fluid. As arsenic may be absorbed through abraded skin or through wounds, sheep should not be dipped until shearing wounds have healed. Careful handling while the sheep are passing through the dip is imperative ; the head of course must be submerged, but it should not be held under.

Draining pens should be at least two in number, and of such size that no sheep need be turned out before all surplus fluid has drained off the wool. From the draining pens each batch of sheep should be released into a small yard with shade, but devoid of herbage, and from this yard they are subsequently turned into the pastures.

Rain falling on freshly dipped sheep may wash some of the dip off, and apart from making the dipping operation less effective, might cause sufficient poison to be deposited on the grass to affect grazing stock. When dipping is completed, the pens and dip should be cleaned thoroughly, and the dipping solution disposed of in such a way that it will not drain into pools or streams.

Careful dipping of sheep is essential.

Symptoms of Poisoning.

The symptoms of poisoning by arsenic are such as would be expected of an intestinal irritant. There is great thirst and profuse salivation, the patient is restless and anxious, and may show colicky pains. Respiration is difficult and short, the extremities become cold, the gait is staggery, and after a time rigors occur, with extreme weakness and collapse ; at first there may be constipation, but it is succeeded by a foetid diarrhoea, with blood present. Death takes place in a few hours in these acute cases, while in sub-acute forms the animal may live for two or three days, during which time the most prominent symptom is a continuance of the blood contaminated diarrhoea.

Post Mortem Appearance.

On post mortem examination, indications of an inflammation of the stomach and intestines (gastro-enteritis) are most marked, and for confirmation of the diagnosis suitable specimens, such as the fourth stomach compartment in sheep and cattle, stomach contents, liver and small intestine, may be collected for chemical analysis. These specimens should be forwarded to the Director of the Veterinary Research Institute, Story-street, Parkville, N.2 (rail to Spencer-street). After a pathological examination, the material is sent on to the Agricultural Chemist for analysis.

Many deaths occur too suddenly to allow treatment, but in other cases, if a reasonably certain diagnosis can be made from the history and symptoms, the affected stock should be given early treatment.

Treatment.

With animals capable of vomiting, an emetic should be given ; salt and water, and mustard, or tobacco mashed up with water are affective for dogs. With any animals, milk, oils, fats, glycerine, and lime-water may be given. Animals suffering from severe diarrhoea should be given small quantities of linseed or barley gruels—1 to 4 pints per day for horses and cattle, up to 1 pint for sheep.

[*Continued on page* 405

Potato Manurial Trials

Results for 1937-38

By J. T. Ramsay, Potato Expert.

The results obtained from tests at Coragulac, Illowa, Neerim, and Beech Forest appeared in the June issue of this Journal.

WHEATSHEAF.

THE plots at Wheatsheaf were sown during November last with the variety Snowflake. In common with the rest of the central highlands, an exceptionally dry season was experienced, and consequently very light yields were harvested. The plots were harvested on 3rd June. The range of variation in yield at this centre was from 1 ton 12 cwt. to 3 tons 2 cwt., the former being from the "no manure" plots and the latter from 3 cwt. superphosphate and 2 cwt. sulphate of ammonia.

While the yields obtained this season are low, the average returns for the past ten years indicate that considerable improvement can be expected from the use of manures, the greatest and most consistent increase being obtained from the "3 and 1" mixture of super. and sulphate of ammonia. During this ten-year period the "3 and 1" application has increased the crop yield by an average of 69 per cent., while on this year's cash values the same dressing shows a substantial profit.

The yields obtained during last season and the average yield over the ten years of the tests are shown in Tables I. and II.

TABLE I.—POTATO MANURIAL TESTS, WHEATSHEAF, 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	2 3	0 11	34
Super., 3 cwt. ..	2 10	0 18	56
Super., 4 cwt. ..	2 14	1 2	69
No manure	1 12	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	2 14	1 2	69
Super., 3 cwt. + sulp. amm., 2 cwt. ..	3 2	1 10	94

TABLE II.—AVERAGE RESULTS, WHEATSHEAF, FOR TEN YEARS, 1928–29 TO 1937–38.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 10	27
Super., 3 cwt.	4 17	37
Super., 4 cwt.	5 0	41
No manure	3 11	..
Super., 3 cwt. + sulp. amm., 1 cwt.	6 0	69
Super., 3 cwt. + sulp. amm., 2 cwt.	6 3	58*

* 6 years only.

A potato planter attached to a three-furrow plough at Romsey.

A crop of Snowflakes on the experimental area at Musk.

ROMSEY.

The Romsey trials were planted on 28th October, 1937, with the Late Carman variety. The potato planting followed a crop of tick beans on this site.

Low tonnages were the result of an exceptionally dry season, the increases from all manurial dressings being very small. The highest yield represented an increase of 19 per cent. only over that of the unmanured portions of the crop (2 tons 2 cwt.). In addition, considerable damage was caused by the potato grub.

The figures for the 1937–38 season are shown in Table III. and the average results obtained over a period of ten years appear in Table IV.

TABLE III.—POTATO MANURIAL TRIALS, ROMSEY, 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	1 19	..	..
Super., 3 cwt. ..	2 5	0 3	7
Super., 4 cwt. ..	2 5	0 3	7
No manure	2 2	..	..
Super., 3 cwt. + amm. sulp. 1 cwt. ..	2 10	0 8	19
Super., 3 cwt. + amm. sulp. 2 cwt. ..	2 9	0 7	17

TABLE IV.—AVERAGE RESULTS, ROMSEY, FOR TEN YEARS 1928–29 TO 1937–38.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	5 11	17
Super., 3 cwt.	5 19	25
Super., 4 cwt.	5 12	18
No manure	4 15	..
Super., 3 cwt. + amm. sulp. 1 cwt.	6 2	28
Super., 3 cwt. + amm. sulp. 2 cwt.	6 5	30*

* 6 years only.

MUSK.

The results obtained at Musk this season were slightly better than those obtained at the other centres. Planting was carried out during the second week of November, Snowflake being the variety used. The crop was put in with a mechanical planter and manure sower. Harvesting was completed during the first week in June.

During the early part of the season the crop showed exceptional promise but, owing to the low rainfall received, it finished below expectations. While the differences between the manured and the unmanured plots were appreciable, they were much less marked than the average in favour of artificial fertilizers shown over the previous nine years. Comparison of the results can be made

from Tables V. and VI. which show the yields obtained last season and the average yield during the past ten years.

TABLE V.—POTATO MANURIAL TESTS, MUSK, 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	2 14	..	..
Super., 3 cwt. ..	3 7	0 10	18
Super., 4 cwt. ..	3 15	0 18	32
No manure	2 17	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	3 17	1 0	35
Super., 3 cwt. + sulp. amm., 2 cwt. ..	4 1	1 4	42

TABLE VI.—AVERAGE RESULTS, MUSK, FOR TEN YEARS, 1928–29 TO 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 6	26
Super., 3 cwt.	4 13	37
Super., 4 cwt.	4 16	41
No manure	3 8	..
Super., 3 cwt. + sulp. amm., 1 cwt.	5 11	63
Super., 3 cwt. + sulp. amm., 2 cwt.	6 8	80*

* 6 years only.

TRENTHAM.

Considering the season, satisfactory returns were harvested from the Trentham plots. The variety planted was Snowflake and a very clean sample was produced.

Wide variations in yield from the manurial dressings were shown, ranging from 3 tons 15 cwt. in the case of no manure to 8 tons 3 cwt. from the "3 and 2" dressing of super. and ammonium sulphate, an increase of 117 per cent.

From the results of eleven years' experimental work at this centre it has been very definitely proved that the optimum rating of superphosphate is 3 cwt. per acre and it does not pay to apply more than that quantity. So far as it has been tested there is a distinct improvement in tonnage to be gained in this particular soil from the heavier dressing of sulphate of ammonia (2 cwt.), compared with the 1 cwt. application, in conjunction with super. During last season the "3 and 2" dressing showed a 20 per cent. increase over the "3 and 1" and for the past six years, i.e., since the introduction of the heavier application of ammonia, the increased yield not only has been constant, but also significant. This, however, does not apply to all districts and growers should exercise care in studying these tests to note if the results obtained are from soils similar to their own. The soil at Trentham is a red volcanic loam and the rotation practised for the last four years has been potatoes 1935, peas for grain 1936, oats for hay 1937, and potatoes 1937.

The results for the past year and a summary of results for eleven years are given in Tables VII. and VIII.

TABLE VII.—POTATO MANURIAL TESTS, TRENTHAM EAST, 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	5 6	1 11	41
Super., 3 cwt. ..	6 4	2 9	65
Super., 4 cwt. ..	6 4	2 9	65
No manure	3 15	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	7 8	3 13	97
Super., 3 cwt. + sulp. amm., 2 cwt. ..	8 3	4 8	117

TABLE VIII.—AVERAGE RESULTS, TRENTHAM EAST, FOR ELEVEN YEARS, 1927–28 TO 1937–38.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 11	51
Super., 3 cwt.	5 6	77
Super., 4 cwt.	5 4	73
No manure	3 0	..
Super., 3 cwt. + sulp. amm., 1 cwt.	6 3	105
Super., 3 cwt. + sulp. amm., 2 cwt.	6 11	118*

* 6 years only.

TOOMBULLUP.

At the request of the North-eastern Potato Growers Association, potato experimental plots were established last season on the property of Mr. G. Stubbs, at Toombullup, about 40 miles from Benalla. For many years past quite an appreciable area of potatoes has been grown in the district, a ready market for which is found in the North-East, and Albury.

The soil at Toombullup is a good, friable red loam capable of producing good crops of fine quality. The country there is rather unique in being at an elevation of 3,000 feet above sea level and is said to be the highest cultivated land in Victoria. The rainfall is in the region of 40 to 50 inches per annum.

A plot of 2 acres of typical land was selected. This area had been out to grass for five years, but prior to that time it had been cropped with potatoes. The variety used was Late Carman and planting was carried out behind a disc plough, during the third week of November last.

TABLE IX.—POTATO MANURIAL TRIALS, TOOMBULLUP, 1937–38.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 3 cwt. ..	4 12	1 14	57
Super., 3 cwt. + pot. sulp., 1 cwt. ..	3 12	0 14	24
Super., 3 cwt. + amm. sulp., 1 cwt. ..	4 13	1 15	60
Super., 3 cwt. + amm. sulp., 1 cwt. + pot. sulp., 1 cwt. ..	4 18	2 0	69
No manure	2 18	..	..
Super., 6 cwt. ..	4 1	1 3	40
Super., 6 cwt. + pot. sulp., 1 cwt. ..	4 2	1 4	41
Super., 6 cwt. + amm. sulp. 1 cwt. ..	5 4	2 6	79
Super., 6 cwt. + amm. sulp., 1 cwt. + pot. sulp., 1 cwt. ..	5 7	2 9	84

Unusually dry conditions for this district were experienced but, in spite of this, substantial increases in yield due to the manures were shown, ranging from 20 per cent. to 84 per cent. Although one year's results are not sufficient on which to base any definite recommendations, it would appear that the "6 and 1" combination of super. and ammonia (7 cwt.) is the application likely to prove most profitable.

Considerable interest was taken in the tests during the season and a field day, which was well attended, was held at the time the weighing was done. To eliminate errors due to soil variation, as far as possible, produce from eight replications was weighed. This is the practice at all centres. The yields obtained are set out in Table IX.

MILLBROOK.

The Millbrook district, in common with most other districts, suffered very much from the dryness of the season, with the result that low yields were experienced. Although no very large increased yields were harvested, the improvement in tonnage due to the various recommended treatments was marked and, in a season of good prices such as this, profitable.

For the first time since dipping tests have been conducted, the untreated seed gave a higher yield than that which was treated. The reason for this is obscure, but the fact is recorded.

In the variety trials the early maturing varieties naturally suffered most from the unfavourable weather conditions. The small yields obtained can be seen in the accompanying table.

VARIETY TRIALS—MILLBROOK, 1937–38.

	T. C.
Bismark	3 0
Earliest of All	2 3
Jersey Kidney	2 6
Epicure	1 12
Catriona	1 17
Abundance	3 7
President	3 2
Snowflake	5 15
Late Carman	4 5
King Edward	4 5
Brownell	5 2

MISCELLANEOUS TRIALS—MILLBROOK.

Treatment.	1937–38.		Average for Twelve Years to 1937–38.	
	Weight Marketable Tubers.	Percentage Increase.	Average Yield.	Percentage Increase.
Cultivation Tests—	T. C.	%	T. C.	%
One cultivation ..	3 12	..	4 14	..
Two cultivations ..	3 18	8	5 13	20
Three cultivations ..	4 13	29	6 11	39
			Average 10 years.	
Immature *v.* Ripe Seed—				
Ripe Seed ..	4 0	..	6 3	..
Immature Seed ..	4 11	13	7 8	20
			Average 12 years.	
Selected *v.* Unselected Seed—				
Unselected	5 2	..	5 19	..
Selected ..	5 12	10	7 9	25
			Average 12 years.	
Storage Tests—				
Bagged seed ..	3 0	..	3 9	..
Boxed seed ..	4 5	42	6 3	78
Dipping Tests—				
Untreated ..	5 7	..	4 1	..
Formalin treated ..	4 11	..	6 16	68

Immature seed again showed to advantage over ripe seed under similar conditions of manuring and cultivation, but not to the same extent as in

previous seasons. The same remark applies to the difference in yields from the selected and unselected seed.

The cultivation tests indicated that three cultivations gave much better results than either one or two horse hoeings. The difference between one and three workings being in the region of 30 per cent.

The importance of correct storage is demonstrated by the 42 per cent. increase in yield obtained from boxed seed as compared with bagged seed.

Arsenical Poisoning of Stock

(*Continued from page* 400.)

As soon as possible, all affected animals should be treated with sodium thiosulphate—the "hypo" used in photography. The dose for horses and cattle is 1 to 2 ounces, dissolved in half a pint of water, while that for sheep is ¼ to ½ ounce; the small doses may be repeated several times daily. Very strong black coffee should be given as a stimulant, and as a laxative, whether purging is taking place or not, raw linseed oil should be given in doses of 1 to 2 pints for cattle and horses and 4 ounces for sheep.

The patients should be kept quiet in shade and nursed well during their illness. Where veterinarians in practice are available, they should be consulted, as they are able to administer antidotes and stimulants very much more effectively by means of injections direct into the blood stream.

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	Number in Herd.	Herd Number.	Name.	Address.	Number in Herd.
1	State Research Farm	Werribee ..	259	10	Banyule Stud Pty. Ltd.	Heidelberg ..	122
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	11	McIntosh, John ..	"Burnwood," Merrigum	31
4	Dennis, Mrs. A. A. ..	Frankston ..	14	12	Black, Mrs. Agnes ..	Mount Noorat	40
5	Lady Talbot Milk Supply Company	Cranbourne ..	418	13	Black, I. S. ..	"The Cottage," Mount Noorat	44
6	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99	14	Read, John D. ..	"Springhurst Estate," Springhurst	99
7	Harris, J. W. ..	"Rowena," Clyde	72	15	Kelly, C. ..	"Glenmore," Creighton's Creek, Euroa	22
8	School of Horticulture	Burnley ..	8				
9.	Lawrence, P. H. ..	"Rainga," Tarrawarra	59	16	Gorman, A. W.	"Cathcart," Alexandra	57

By J. L. Provan, B.Agr.Sc., Senior Horticultural Instructor.

Orchard Notes.

DURING August the deciduous fruit trees commence their seasonal activities. Early-flowering varieties of the peach, nectarine, apricot, and plum will commence blooming during this month, and the majority of almond varieties will be in full-bloom. Early-blossoming varieties of pears and cherries, will show bud-movement but will not bloom until September. The importance of this bud-movement lies in its connexion with the preventive spray programme for the control of fungus diseases. If the early stages of bud development are allowed to pass without protective spray applications, and subsequently, climatic conditions favour fungus growth, great difficulty will be experienced in the production of clean fruit.

Before sprays are applied ploughing should be completed. The stirring of the soil during periods which are favourable to fungus infection is an undesirable practice. Cultivation around the base of each peach, apricot and cherry tree should be thorough to destroy the over-wintering stage of the brown rot fungus.

When the blossom buds of apricot and peach trees have reached the "pink-bud" stage, a 6 : 4 : 40 Bordeaux mixture should be applied for the prevention of brown rot, and curly leaf. This spray will also assist in preventing shot hole and scab, and freckle of the apricot. Subsequent cover sprays of other materials, to control these diseases, will be mentioned in these columns at a later date.

It is now too late to apply tar distillate sprays to peach trees for the control of green peach aphis, and growers who have not used this effective ovicide will have to rely on repeated applications of nicotine sulphate and soft soap to prevent later ravages of this pest.

August is a particularly good time to apply fertilizers to the deciduous orchard and the citrus grove. The advantages of an early application are that the plant foods will reach the feeding root-zone when the plant requires them and they will have their maximum beneficial effect on the setting of the crop. The amount and type of fertilizers to be applied will depend on the past history of the trees in respect to growth and fruitfulness. Where annual growth is poor, nitrogenous fertilizers will be found most useful. In light soils where leaching of plant foods occurs,

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applications of a complete fertilizer, of the 2 : 2 :1 type, at the rate of 5 lb. or more per tree, will generally be of benefit.

In the sandy and loamy soils of northern Victoria, particular attention should be paid to fertilizers of the 2 : 1 or 3 : 1 type, i.e., two parts of superphosphate to one part of sulphate of ammonia, and the rate of application will vary from 6 lb. per tree upwards according to the tree's vigor. The loamy soils of northern Victoria are well supplied with available potash, and, except on the lighter soil types, applications of potash may not be needed. It is very important that the superphosphate and sulphate of ammonia mixture should be ploughed under early, because portion of the superphosphate reverts to the insoluble form very quickly and the tree requires its phosphoric acid supplies in the early stages of growth.

A good plan to ensure adequate cross-pollination of those varieties of fruit trees which require cross-pollination to set commercial crops is the hiring of hives of bees. In some fruit-growing districts this is a regular annual practice and the results are considered to be very satisfactory. About one hive per acre is necessary for effective cross-pollination.

The Flower Garden

By A. W. Jessep, M.Agr.Sc., B.Sc., Dip.Ed., Principal, School of Horticulture, Burnley

The Flower Garden.

THE garden should, ere this, have had its winter clean up; if not, the task must be undertaken at once, as plants are now commencing to grow. The replacement of roses and other deciduous plants should be hastened, so that they may have reasonable opportunity to become established before the warm weather.

Make sowings of the following seeds :— Ageratum, antirrhinum, delphinium, lupin, scabious, candy tuft and larkspur. Set out clusters of herbaceous plants, such as delphinium, perennial aster, agapanthus, canna and perennial phlox.

When selecting shrubs, some of those which yield berries should be chosen for, though their flowers are insignificant, the berries give colour to the garden, when there is the greatest lack of blossom, and they are very useful in the early winter for indoor decoration. Birds are rather fond of some kinds, but others they practically never touch. Even if the birds do take a share, this should be regarded as a reward for destroying harmful insects, such as aphis, caterpillars and snails.

The most popular berry shrubs are the cotoneasters. They are somewhat like a hawthorn but without thorns; they are not such vigorous growers and the leaves are not of such a bright green. Some are evergreen; others are deciduous. Some are erect and grow into large shrubs, others are compact and shrubby, while others again have a more or less weeping habit. There are also prostrate and creeping forms which are ideal for rock gardens and stone walls.

The delphinium.

The flowers are small and usually white or pale pink; the berries are commonly bright red, but occasionally orange.

Cotoneasters prefer a good open position and do reasonably well in almost any type of soil.

Cotoneaster pannosa is a vigorous grower with an attractive pendulous habit, and bears pannicles of red berries. *C. serotina* is also a vigorous grower and its bright red berries last throughout the winter. *C. horizontalis* is a very good prostrate form with small glossy leaves, which colour in autumn. It produces flat, fan-like spreading branches, which make it very useful as a rock plant. There is a variegated form of this variety.

Crataegus is the name given to the deciduous hawthorn; Pyracantha to the evergreen. There are several species, most of which are hardy under general soil conditions. They are mainly vigorous growers and develop into large shrubs or small trees. Although sometimes used for hedges, they give a much better yield of berries, when allowed to grow as specimens, and are pruned very sparingly.

The popular *Pyracantha crenulata* has dark green foliage and produces white flowers in the spring, followed by vivid red berries in the autumn. Unfortunately, birds are rather fond of them and frequently strip the bush of them.

P. coccinea is another good variety. It has slender, pale green leaves and produces clusters of brilliant red flowers.

Crataegus angustifolia is a good sturdy grower. It is deciduous, as are all the Crataegus types. The leaves are long and narrow, and the white flowers are followed by orange berries.

C. cordata has white flowers in the spring and gives a magnificent display of foliage in the autumn. The bright red berries are seldom seen, as the birds are so fond of them.

C. Korolkowi has a leaflet somewhat like that of an apple and produces bunches of large red berries, about the size of cherries.

C. mexicana is similar in appearance to Korolkowi, but bears orange berries in the winter.

Ilex, the Holly: Good hollies, in berry, are a beautiful sight, but very often plants do not produce berries, probably because they are seedlings. Nurserymen now graft scions from good berry-producing plants on to seedlings, with usually satisfactory results. The holly grows best in the hills, but if given a cool place and plenty of water, it will thrive in lower country.

Sorbus Aucuparia, the Rowan Tree or mountain ash, is a wonderful tree in the higher altitudes. It produces large clusters of scarlet berries, but does not berry so well in the lowlands. Berberis, the Barberry family, contains a number of hardy shrubs, some of which yield very decorative berries and autumn foliage. They do very well in a warm position. *B. coryi*, *B. aggregata*, and *B. polyantha*, are three hardy ones, which produce clusters of coral red berries, attractive on the bush and useful for indoor decoration.

Cornus is commonly called the Dogwood. The popular variety, *Cornus capitata*, has pale yellowish-green flowers, followed by berries somewhat similar to a large strawberry. *C. mas* resembles it somewhat, but the berries are red in colour and are borne in bunches.

There are several other useful berry shrubs, including *Arbutus unedo*, the Irish strawberry; *Euonymus europaeus*, the European spindle tree; *Symphoricarpus*, the snowberry; and *Photinia*, the Chinese hawthorn.

Vegetables.

The vegetable garden should be in good condition for the sowing of early summer plants. Seeds of the following should be sown in specially prepared beds:—lettuce, early carrots, cabbages, red beet, peas, radish and swedes. Sow under glass an early plot of tomato and celery seeds. Final sowings should be made of broad beans. If any herbs or berry fruits are to be planted, they should be put in as soon as possible, as it is already rather late for such plantings.

Red beet is very useful for salads and pickles. Being a root crop, a deep light soil is the most suitable. If the soil is any way heavy, it should be worked deeply, otherwise the roots will be forked; this will detract from their value for culinary purposes. If farmyard manure is used, it should be well rotted and buried at least a spade's depth below the surface, some weeks before the seed is sown. There are long varieties; others are round or turnip shaped, but for most purposes the round variety is to be preferred. It matures more quickly and is easier to handle. It must be remembered, when preparing the ground, that the longer varieties grow to a greater depth than do the turnip-shaped types. Sow the seeds thinly in rows about 15 in. to 18 in. apart, and when the plants are well above ground, thin out, leaving from 4 in. to 6 in. between them. As the same pod may contain more than one seed, the thinning out must be carefully done. They should mature in from three to four months. When cultivating or lifting, care must be taken not to cut or injure the roots, as a wound or broken root allows the sap to escape, and so causes the beets to lose their colour.

Two popular round varieties are Crimson Globe and Detroit Improved Dark Red, while Obelisk is a long-rooted variety.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

A Preliminary Note on the Relation of Zinc to Disease in Cereals

By C. R. Millikan, M.Agr.Sc., Plant Pathologist

EXPERIMENTS commenced in 1936 by the Department of Agriculture on the farm of Mr. C. P. Dahlenburg at Nhill in relation to the control of the eelworm (*Heterodera schachtii*) and root rot diseases of cereals, have led to some interesting developments in connexion with the use of zinc. Large increases in yield have been obtained as a result of small applications of zinc sulphate to the soil, but the exact nature of these responses is at present not fully determined.

The experiment was on a typical Wimmera grey soil (pH8·2) carrying a heavy infestation of *H. schachtii* (Fig. 1). In addition, certain root rot fungi, indicated below, occurred freely throughout the area. Six different soil treatments, including zinc sulphate, were given. The zinc sulphate was mixed with superphosphate and sown at the rate of 31 lb. zinc sulphate plus 115 lb. of superphosphate per acre. The control plots received a dressing of superphosphate, 115 lb. per acre. An analysis of the zinc sulphate used is shown in Table 1. Each treatment was in duplicate in randomized blocks, the individual plots being fourteen drill rows wide and 0·0346 acres in area. The variety of wheat sown was Free Gallipoli.

The effect of zinc sulphate on the general growth of the wheat was outstanding. From germination to harvest the plants receiving this treatment were far superior to all others, both as regards general growth and depth of colour in the leaves. Whereas the plants in all the other treatments included in this experiment were pale yellowish green in colour in the early stages of growth particularly, those treated with zinc were deep green in colour. The zinc treatment also induced early maturity as the plants commenced heading approximately two weeks before those treated with superphosphate alone.

Fig. 1.—Cysts of **Heterodera schachtii** *on roots of wheat.—Nhill.*

During the season several representative samples of 40 to 50 plants were dug from these plots and were examined to determine the effect of the treatment on the development of the eelworm and root rot diseases. These examinations showed that the zinc treated plants produced a much superior root development than did the controls, the adventitious roots in particular of the former being stronger and more vigorous. No difference in eelworm infestation of the primary roots of the wheat plants in either treatment occurred. Eelworm cysts were also produced on the adventitious roots of the zinc treated plants, but owing to the markedly superior development of these roots the effect of this infestation was not so severe, as on the poorer developed roots of the plants treated with superphosphate alone.

Fig 2.—Wheat plant from Nhill showing lesions caused by root rot fungi.

Observations on the effect of the treatment on the occurrence of root rot lesions (Fig. 2) indicated that in general these were more severe on the roots of the plants treated with superphosphate alone as compared with those treated with superphosphate plus zinc sulphate. From cultures of these lesions the following fungi were isolated :— *Rhizoctonia solani*, *Helminthosporium sativum*, *Helminthosporium* sp., *Fusarium* sp., *F. culmorum*, *Curvularia ramosa*, and *Curvularia* sp.

The yields of grain obtained from the experiment were as follows :—

Treatment.	Yield. bus. per. acre
Superphosphate 115 lb. per acre ..	29·1
Superphosphate 115 lb. per acre + Zinc sulphate 31 lb. per acre	38·5
Standard error	0·46

The treatment with zinc sulphate resulted in a significant increase in yield of 9·4 bushels per acre (32·3 per cent.) over superphosphate alone. From the results of the examination of plants indicated above, it seemed evident that this increase in yield was mainly related to the superior root development of the zinc treated plants which in turn had some effect on the severity of eelworm and root rot symptoms. This superior root growth enabled the plants to withstand the deleterious effect of these organisms better than the untreated plants with the resultant improved growth and yield. It was not possible from this experiment to determine the nature of the response of the plant to the zinc sulphate treatment, resulting in increased root development and yields.

In view of the results of the above experiment, zinc treatments were included in field experiments at Nhill, Salisbury and Longerenong Agricultural College in the Wimmera District, and at the Mallee Research Station, Walpeup, during 1937. Observations were also made in that year on the effect of small applications of zinc sulphate on several bulk areas of crop totalling in all approximately 70 acres in the Nhill and Salisbury districts. A preliminary observation was also made on the effect of this treatment on oats at Nhill.

At the Plant Research Laboratory, Burnley, a zinc deficient treatment was included in the wheat mineral deficiency experiments being conducted at that centre, to determine the effect of zinc deficiency on the growth of the wheat plant and its relation to the responses to zinc sulphate obtained in the field.

Field Experiments, 1937.

Samples of the zinc sulphate used in the 1936 and 1937 experiments were submitted to the Agricultural Research Chemist for analysis, the results of which are shown in Table I :—

TABLE I.—ANALYSIS OF ZINC SULPHATE USED IN THE 1936 AND 1937 FIELD EXPERIMENTS.

—	1936 Sample.	1937 Sample.
	Per cent.	Per cent.
Zinc sulphate ($ZnSO_4 7H_2O$)	99·0	99·4
Manganese (Mn) ..	0·0083	0·064

These analyses showed that the commercial material used was very pure, containing 99·0 per cent. or more of zinc sulphate.

At Longerenong and Walpeup the effect of applications of 15 and 30 lb. of zinc sulphate per acre, in conjunction with superphosphate was studied, and in addition a treatment consisting of 30 lb. of zinc sulphate per acre alone was included.

Plots embracing these treatments were also laid down in 1937 at Nhill, but these must be regarded as purely observational in character in view of the fact that the site, which was the only one available, had a somewhat uneven history.

At Salisbury, where the trial was made on the farm of Mr. E. W. Dahlenburg, superphosphate plus zinc sulphate 30 lb. per acre was the only zinc treatment studied.

The responses to the zinc treatment at Nhill and Salisbury were similar to that obtained in the previous year's experiment. The 15 lb. per acre treatment at Nhill was as good as the 30 lb. per acre treatment in appearance. Early in the season, the plants treated with zinc at both centres were markedly superior in growth and depth of colour in the leaves (Fig. 3), commenced heading approximately a fortnight earlier than the controls (Fig. 4), produced a superior root system, and gave a considerable increase in yield. On the other hand, the plots treated with zinc sulphate 30 lb. per acre alone at Nhill were inferior in appearance to those receiving superphosphate alone, and gave a decreased yield (Table II). The treatments at Salisbury were sown in duplicate, the variety of wheat being the crossbred Major x Free Gallipoli.

At Longerenong, where the plots were sown with Ghurka wheat, each treatment was replicated four times. The response to the zinc treatment at this centre was not comparable with that obtained from the other Wimmera plots. The growth of plants from all treatments was good but a slightly darker green colour was apparent in the plants treated with superphosphate plus zinc sulphate 15 lb. per acre.

During the season, samples of 40 to 60 plants from each plot at Nhill and Longerenong, and 150 plants from Salisbury were obtained and examined for the occurrence of disease. Cysts of *H. schachtii* were present only on the samples from Nhill. Root rot lesions were found to be much more severe on the plants from Nhill and Salisbury as compared with those from Longerenong.

In an attempt to demonstrate quantitatively these differences in the severity of disease in the plants from the different centres and also the effect of the zinc treatment on the disease, each plant in the sample was classified for disease and allotted points as follows:—Severe infection—3 points, moderate infection—2 points, Light infection—1 point, and no infection—no points. An index of the severity of the disease in the sample was then obtained as under:—

$$\text{Severity index} = \frac{\text{Total points scored}}{(\text{Total number of plants in the sample}) \times 3} \times \frac{100}{1}$$

The results of this examination of the plant samples are shown in Table II. This method proved to be not entirely satisfactory particularly in the case of very lightly infected plants where

Fig 3.—Showing the effect of zinc sulphate on the growth of wheat in tests at Nhill 1937. Left, superphosphate 1 cwt. per acre; right, super 1 cwt. + zinc sulphate 15 lb. per acre.

Fig. 4.—The same plots (shown in Fig. 3) at heading time. Note the early maturity of the zinc-treated plants (right).

the allocation of one point was greater than the severity of the disease lesions warranted.

Owing to the non-randomized distribution of the plots at Salisbury, it was not possible to calculate the statistical accuracy of the results. There can be no question, however, as to the significance of the effect of zinc sulphate applications on the growth and yield of wheat at this centre. The high severity indexes recorded for Nhill and Salisbury indicate the heavy disease infection which occurred at these centres.

It was not possible to demonstrate a significant difference between the severity indexes obtained at any particular centre. The apparent drop in the severity index recorded for the zinc treatment at Salisbury is of interest, however, as it is in accord with field observations made on these plots. In several instances, plots treated with superphosphate alone on either side of the zinc treated plots showed adjacent areas in which severe symptoms of root rot injury developed in the plants, i.e. stunted growth, yellowish colour and browning of the tip of the leaves, and the presence of lesions on the roots, whereas the zinc treated plots in between were uniformly dark green in colour and even in height throughout.

From the above it was evident that the zinc sulphate treatment at this centre had at least helped the plants to overcome the deleterious effect of root rot infection. The effect of the

TABLE II.—SEVERITY INDEXES OBTAINED FROM THE EXAMINATION OF SAMPLES OF PLANTS FROM THE ZINC SULPHATE EXPERIMENTS AT NHILL, SALISBURY, AND LONGERENONG FOR THE OCCURRENCE OF DISEASE, AND YIELDS OF GRAIN RESULTING FROM THE TREATMENTS AT SALISBURY AND LONGERENONG.

Treatment.	Root rot lesions severity index.	Eelworm severity index.	Yield.	
			Bushels per acre.	Increase due to zinc sulphate
		(a) Nhill.		
Superphosphate 1 cwt./ac.	83	87	..	..
Superphosphate 1 cwt./ac. + zinc sulphate 15 lb./ac.	82	75	..	..
Superphosphate 1 cwt./ac. + zinc sulphate 30 lb./ac.	76	77	..	..
Zinc sulphate 30 lb./ac. ..	75	83	..	..
		(b) Salisbury.		
Untreated	..	..	36·9	..
Superphosphate 1 cwt./ac.	71	..	47·4	..
Superphosphate 1 cwt. + zinc sulphate 30 lb. ..	54	..	56·8	19·8
		(c) Longerenong.		
Untreated	..	..	37·6	..
Superphosphate 1 cwt./ac.	33	..	41·0	..
Superphosphate 1 cwt./ac. + zinc sulphate 15 lb./ac.	34	..	43·1	5·1
Superphosphate 1 cwt./ac. + zinc sulphate 30 lb./ac.	34	..	41·3	0·7
Zinc sulphate 30 lb./ac. ..	..	..	39·6	..
Standard Error	..	..	0·91	..

treatment on the root rot complex at Nhill is complicated by the occurrence of eelworms.

The full significance of the fact that the greatest responses to the zinc sulphate treatment in the Wimmera district have been obtained in areas carrying the heaviest infestation of root rot fungi or eelworm has yet to be determined. The fungi present in the Nhill area have been recorded above. From the lesions on the roots of the plants from Salisbury, the following fungi were isolated:—*Helminthosporium* sp., *Rhizoctonia solani*, *Fusarium* sp., and *Macrosporium* sp. From the Longerenong plants the fungus *Fusarium* sp. was isolated.

Observations were also made on bulk areas of wheat in the Nhill and Salisbury districts approximating 70 acres which were treated with zinc sulphate. Similar responses to those recorded above were obtained, viz.—deeper green colour, increased growth, early maturity, and increased yield. (Fig. 5.)

Preliminary observations were made during 1937 on the effect of zinc sulphate on the growth of Mulga oats. Two plots only were sown, one treated with superphosphate 1 cwt. per acre plus 30 lb. of zinc sulphate and the other with superphosphate 1 cwt. per acre. The plots were sown in fallow. The response of the zinc treated oats was similar to that recorded above for wheat. The plants showed very superior growth and deeper green colour than the control plants and commenced heading approximately two weeks before them. Similar results with the use of 89 per cent. zinc sulphate on oats have been recorded by Barnette et als (2).

In the preliminary experiment at the Mallee Research Station, Walpeup, in 1937, the variety of the wheat used was Ranee 4H and each treatment was replicated four times. The test was sown on an area which was cleared in 1933 only, sown to wheat 1934, oats 1935, and fallowed 1936. Practically no response to the zinc treatment was

TABLE III.—YIELDS OBTAINED FROM THE EXPERIMENT WITH ZINC SULPHATE AT THE MALLEE RESEARCH STATION, WALPEUP, 1937.

Treatment.	Yield.
	bus./ac.
Untreated	33·1
Zinc sulphate 30 lb. per acre alone ..	31·6
Superphosphate 90 lb. per acre ..	37.4
Superphosphate 90 lb. per acre + zinc sulphate 15 lb. per acre	37·4
Superphosphate 90 lb. per acre + zinc sulphate 30 lb. per acre	38·0
Standard error	0·63

Fig. 5.—Left, Portion of bulk area treated with zinc sulphate, Salisbury 1937. Note the superior growth and early maturity compared with the crop treated with superphosphate only (right). Both areas were sown with the same variety on the same day.

noticeable throughout the season on this area, and there was no significant difference in yield, over the plants receiving superphosphate only. The growth of the plants receiving zinc sulphate 30 lb. per acre alone was very inferior to those receiving superphosphate in addition to zinc sulphate. The yields obtained from this experiment are shown in Table III.

An examination of plants from this experiment indicated that disease was not a limiting factor to the growth of the plants to the same extent as on Mallee areas which have been under cultivation for a much longer period.

Effect of Zinc on Quality of Grain.

Samples of grain harvested from the experimental plots at Salisbury, Nhill, Longerenong, and Walpeup were submitted to the Agricultural Research Chemist for examination as to any effect the zinc treatment may have had on the milling and baking quality of the resultant wheat. These samples included grain from plots receiving superphosphate only and from those receiving in addition, 15 and 30 lb. respectively of zinc sulphate. At two centres, Longerenong and Walpeup, samples were included from the "no manure" and from the "zinc sulphate" only, 30 lb. plots. The Agricultural Research Chemist reports that, as the result of a thorough investigation, it is apparent that the zinc treatments have no significant influence on the milling and baking quality of the wheat irrespective of whether an increase in yield was obtained, samples from zinc plots, either 15 or 30 lb. per acre, being similar to those from the corresponding check plots. These investigations included chemical analyses as well as extensive milling and baking tests. The results are all the more conclusive in that four different wheat varieties were involved, the variety being different at each locality.

The role of zinc in plant nutrition has not been determined. It is thought by Chandler (4) to act as a catalytic agent in some essential reaction. For certain diseases of fruit trees characterized by a mottling or malformation of the foliage, zinc sulphate has been found to be valuable as a specific. In this regard, satisfactory control of mottle leaf of citrus in Victoria and other States of Australia (3, 9) by means of zinc sulphate sprays, has been obtained. Work by Chapman, Vanselow and Liebig (5) on the relation of zinc to this disease suggests that mottle leaf of citrus is a manifestation of zinc deficiency, rather than that this element acts as an antiseptic or corrective.

As a result of experiments on the cause of little leaf or rosette of fruit trees Hoagland et als (7) suggest that zinc deficiency is the immediate cause of little leaf and related diseases, though in some cases zinc deficiency in the plant may result from the activities of soil micro-organisms. This relation of little leaf to the soil micro-flora, is supported by the work of Ark (1) and is of particular interest in view of the results obtained with zinc sulphate on wheat in the Wimmera district of Victoria where soil organisms have been shown to markedly affect the growth of the wheat plant.

The possibility of the zinc treatment inducing variations in the soil fungi is suggested by the work of Dimock (6). In studies with a strain of *Fusarium* sp. he found that on media sectors were frequently induced by the action of zinc salts.

Preliminary studies have been made of the effect of small concentrations of zinc sulphate on the growth of root-rot fungi on artificial media. The medium used was glucose agar, which had the following composition:—Glucose, 15 grams; agar, 17 grams, and distilled water, 1,000 c.cs. Chemically pure zinc sulphate was added to portions of the glucose agar, so that its concentrations in the final media were nil, 0·1, 0·25, and 0·5 per cent. respectively.

Fig. 6.—Showing the effect of small concentrations of zinc sulphate on the growth of Helminthosporium *sp. on glucose agar incubated at 25° C. for six days. Top left, nil; right, 0·1 per cent. Bottom left, 0·25 per cent.; right, 0·5 per cent.*

The tests were conducted in 4-in. petri dishes, each containing 15 c.cs. of the agar medium. Each treatment was replicated three times.

Fig.7 .—Cultures of **Culvularia ramosa** *grown on glucose agar for ten days at 25° C. Compare speculation on medium containing no zinc (left) with that on medium containing 0·1 per cent. zinc sulphate (right).*

Vigorously growing cultures of *Curvularia ramosa* and *Helminthosporium sativum* were used for the experiment. After the transfer of the cultures, the plates were incubated at 25° C., and the growth of the colonies measured after four and six days. The results are summarized in Table IV.:—

TABLE IV.—SHOWING THE EFFECT OF ADDING SMALL QUANTITIES OF ZINC SULPHATE TO GLUCOSE AGAR, ON THE DIAMETER OF COLONIES OF CURVULARIA RAMOSA AND HELMINTHOSPORIUM SATIVUM WHEN CULTURED IN PETRI DISHES AT 25° C.

Treatment.	*Curvularia ramosa.* Colony diameter (m.m.) after—		*Helmintho-sporium sativum.* Colony diameter (m.m.) after—	
	Four Days.	Six Days.	Four Days.	Six Days
Glucose agar	45	67	35	45
Glucose agar + 0·1 per cent. zinc sulphate ..	22	30	16	19
Glucose agar + 0·25 per cent zinc sulphate ..	17	22	9	11
Glucose agar + 0·5 per cent. zinc sulphate. ..	13	19	7	10

From these results it is clear that the addition of small quantities of zinc sulphate to the medium resulted in a marked retardation in the growth of the fungi, particularly in the higher concentrations (Fig. 6).

The cultures were examined, after ten days' growth when it was found that the zinc had induced marked variations in the fungi. At this stage, the cultures without zinc were sporulating freely, while all the cultures grown on media containing zinc showed no signs of spore production, while the mycelium had become somewhat bead-like in appearance (Fig. 7).

The effect of nematodes on plant nutrition has been investigated by Magistad and Oliveira (8). They have shown that the infestation of pineapple roots by *Heterodera marioni* significantly affected the response of the plant to the application of fertilizers. The relation, therefore, of *H. schachtii* and the soil micro-flora to the response of cereals to zinc sulphate in Victoria remains to be determined.

Summary.

Compared with plants receiving superphosphate only applications of 15 and 30 lb. of zinc sulphate per acre in conjunction with superphosphate have resulted in a very superior growth, earlier maturity, and increased yield of wheat in certain areas in the Wimmera district of Victoria.

The significance of the fact that the most marked responses to this treatment have been obtained on areas carrying the greatest infestation of root fungi and eelworms (*Heterodera schachtii*) has not been determined. The evidence obtained indicates that this treatment assisted the plants to withstand the deleterious effects of these organisms.

A preliminary observation indicates that the response of oats to zinc sulphate at Nhill is similar to that obtained in wheat.

In a preliminary experiment with wheat in sand cultures the addition of zinc to the nutrient solution did not produce an increased growth comparable with that produced in the field.

Marked variation was induced in *Curvularia ramosa* and *Helminthosporium sativum* when grown on glucose agar containing small concentrations of zinc sulphate.

Chemical analyses and extensive milling and baking tests indicated that the zinc treatment had no significant influence on the milling and baking qualities of wheat.

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Codling Moth and Black Spot Control

(*Continued from page* 385).

and Gravenstein varieties. For Jonathan it is recommended that the 6 : 4 : 40 Bordeaux mixture be applied at an *early* " green tip " stage.

PEARS.

The various stages of growth of pears at which sprays are applied and the strength of such sprays are as follow :—

1. *Delayed Green Tip.*—When the maximum number of fruit buds has brown scales or bracts separating and the tips of the green folded leaves are just visible. Apply Bordeaux mixture 6 : 4 : 40.

2. *Finger.*—When the green leaves are separated from the blossom buds which are beginning to separate in the cluster but before white petals appear. Apply Bordeaux mixture 6 : 4 : 40.

3. *Late Calyx.*—About three weeks after the fruit has formed apply Bordeaux mixture 3 : 3 : 50.

The above schedule is suitable for the W.B.C. and Beurré Bosc varieties. Only one Bordeaux mixture (6 : 4 : 40) should be applied to Josephine pears and this should be at an early " green tip " stage. This stage is slightly earlier than that described as Delayed Green Tip above. Any further Bordeaux sprays will russet this variety. For Winter Nelis the application of the " finger " spray must be completed before any petals show pink, while the late calyx spray must not be applied within three weeks of petal-fall. For clean skinned varieties, such as Packham, apply 1 : 1 : 50 Bordeaux mixture at the late calyx stage.

Control of Summer Spot.

If the above schedules are carefully adhered to, little trouble should be experienced with late or summer black spot. If late spot does appear, 6 oz. each of bluestone and freshly-slaked lime should be included in each 100 gallons of lead arsenate or white oil spray. Growers who prefer to use lime-sulphur for apples should use it at a strength of 1 to 1¼ gallons in 100 gallons of water.

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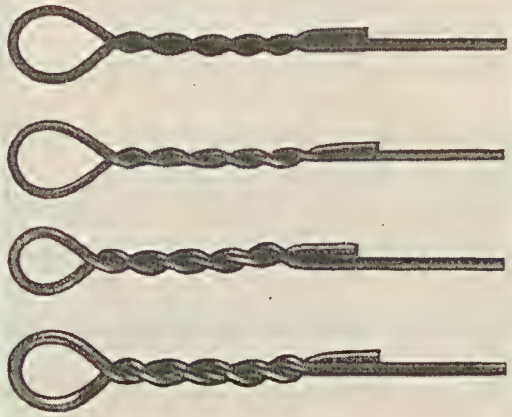

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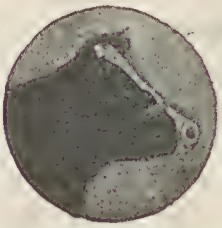

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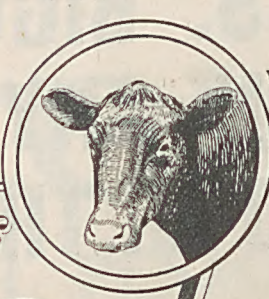

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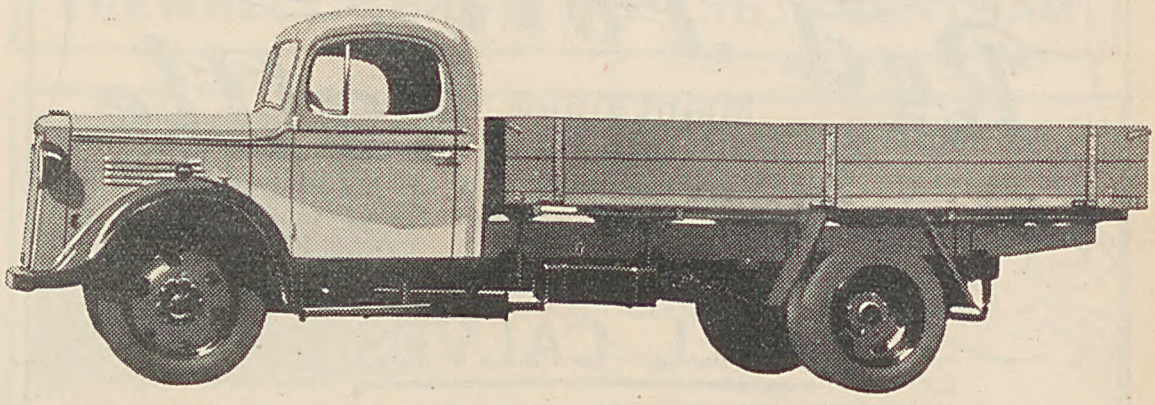

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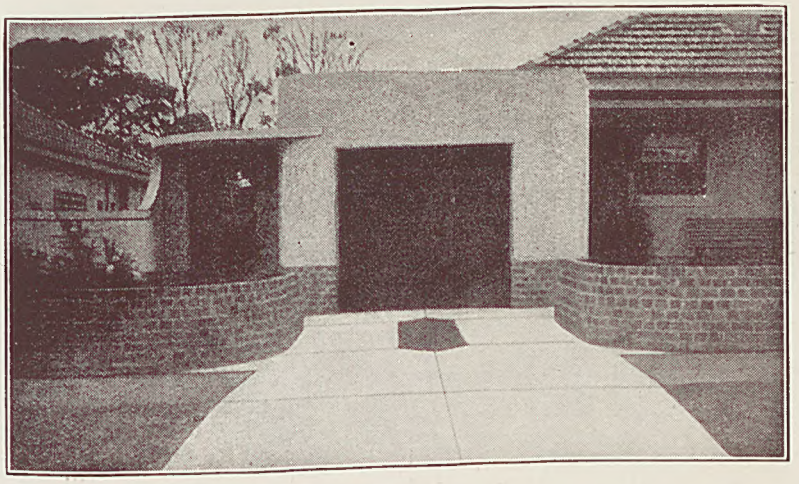

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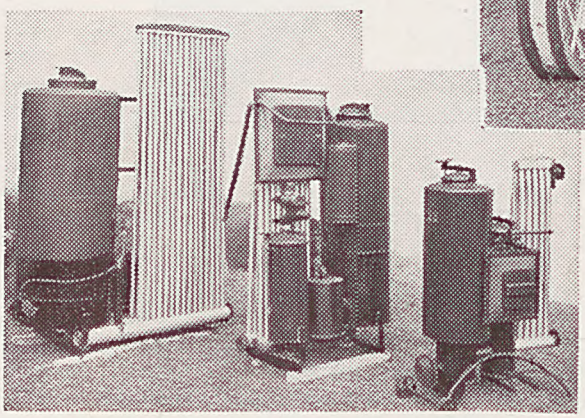

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